



# **Armed Forces College of Medicine AFCM**



# ***Lung and Pleura***

***Dr. Gamal T. Abdelhady***  
***Lecturer of Anatomy***

# ***INTENDED LEARNING OBJECTIVES (ILO)***



**By the end of this lecture the student will be able to:**

1. Define the pleura, its layers & parts.
2. Describe the nerve, blood supply, lymphatic drainage & surface anatomy of the pleura.
3. Recognize the related relevant clinical problems to the pleura
4. State the stages of development of the respiratory tract & list the possible congenital anomalies.
5. Describe the shape, surfaces, borders of each lung.
6. Compare between right and left lungs regarding root, lobes, fissures, relations.
7. Define the bronchopulmonary segments and realize their clinical importance.
8. Describe the blood, nerve supply, lymphatic drainage and surface anatomy of the lung

# ***Compartments of the Thoracic Cavity***



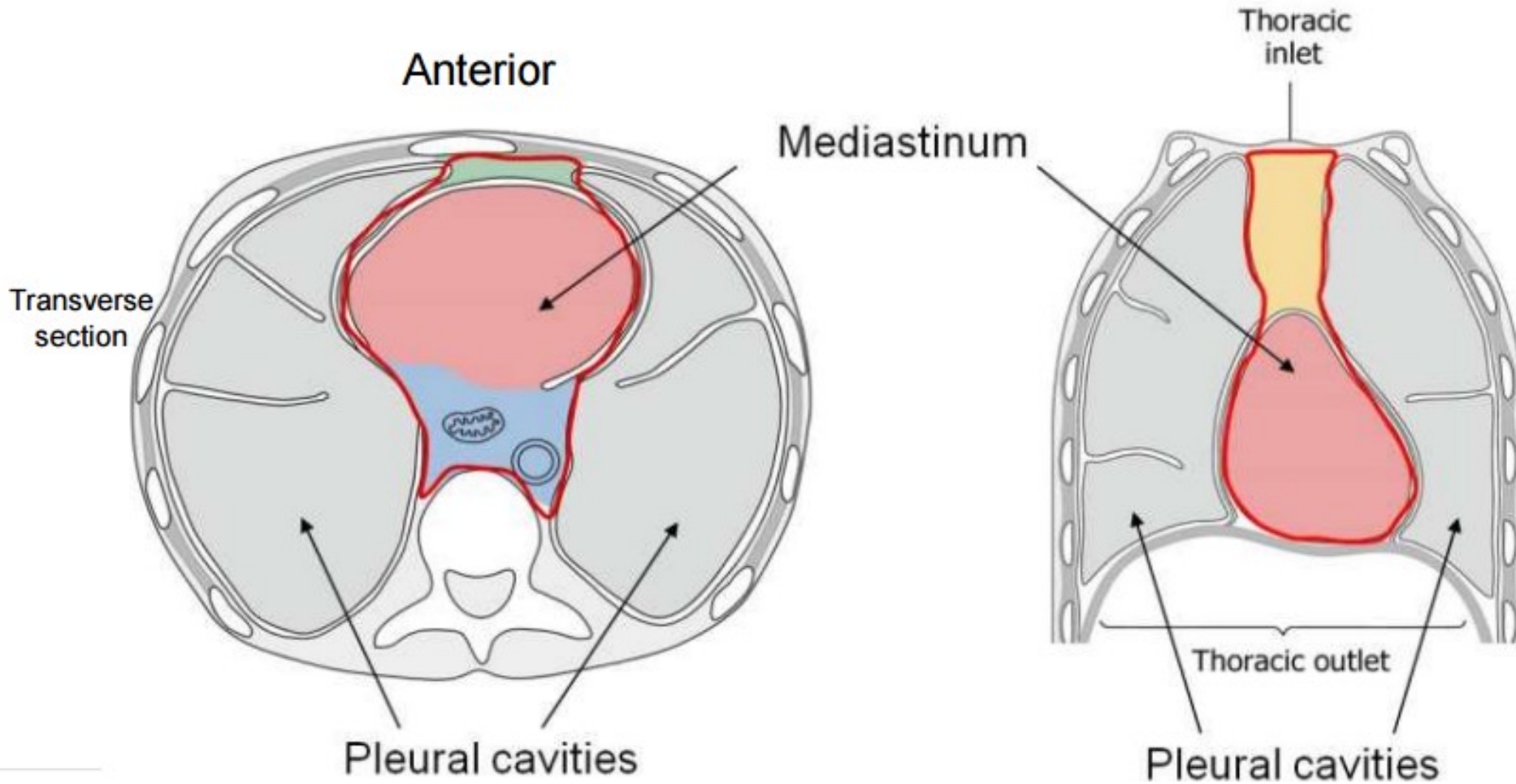
***Thoracic cavity is divided into three compartments:***

Two Lateral → **Pleural cavities**

One Central → **Mediastinum**

**Two pleural cavities, one on either side of the mediastinum, surround the lungs**

# ***Compartments of the Thoracic Cavity***



# ***Pleura***



Each compartment of the chest cavity is lined by a single layer of flat cells, mesothelium, and an associated layer of supporting connective tissue, together, they form the **pleura**, **formed of 2 separate layers**

## ***The Pleural cavity:***

Is a small space between the visceral and parietal pleurae.

It contains a small amount of lubricating fluid (Pleural fluid) secreted by the two layers.

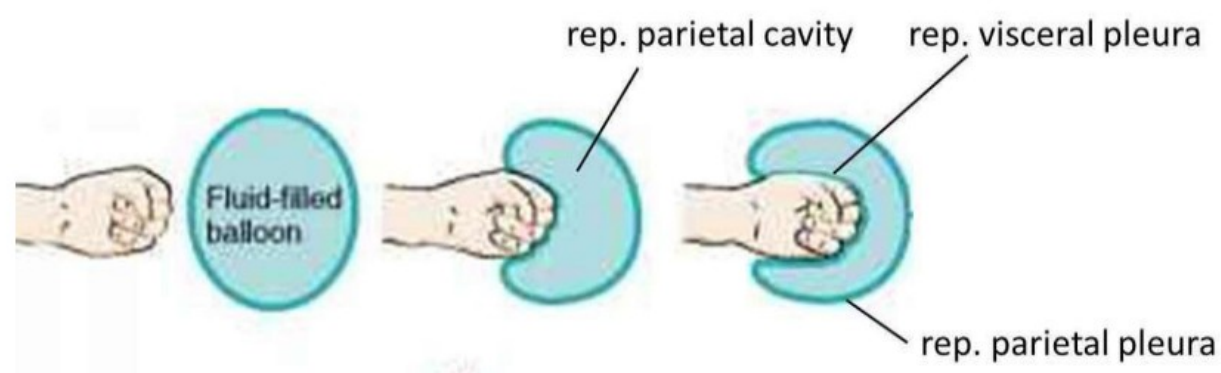
# ***Pleura***



***The pleura is divided into two major types, based on location:***

***Parietal pleura:*** The superficial layer lining the wall of the thoracic cavity.

***Visceral pleura:*** The deep layer that adheres to the lungs.

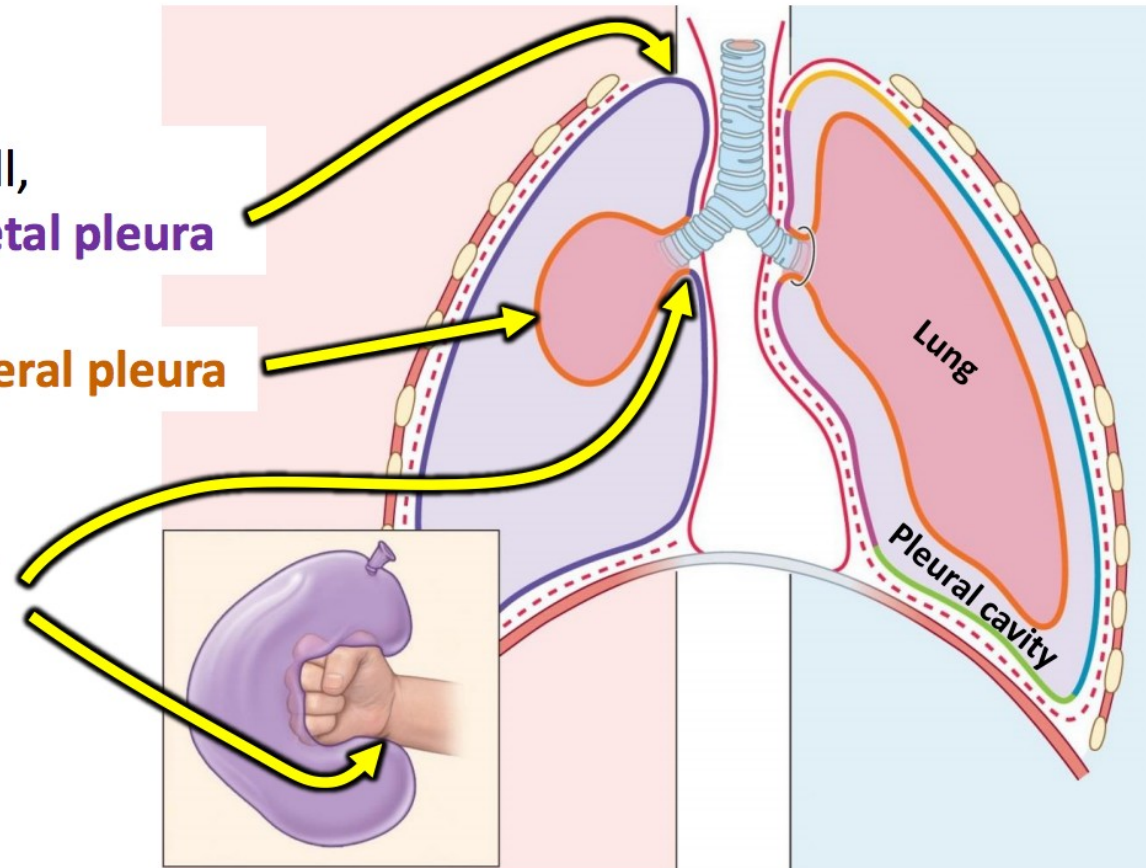


# ***Pleural cavity***

Pleura that adheres to thoracic wall, mediastinum, & diaphragm – **parietal pleura**

Pleura that adheres to lungs – **visceral pleura**

Area of continuity btw parietal & visceral pleurae – **pleural sleeve**





# ***Pleura***



- The names given to the parietal pleura *correspond to the parts of the wall with which they are resting upon:*

***1. Costal part:*** covers the internal surface of the thoracic wall

***2. Diaphragmatic part:*** covers the superior thoracic part of the diaphragm.

# Pleura



**3. Mediastinal pleura:** covers the lateral sides of the mediastinum.

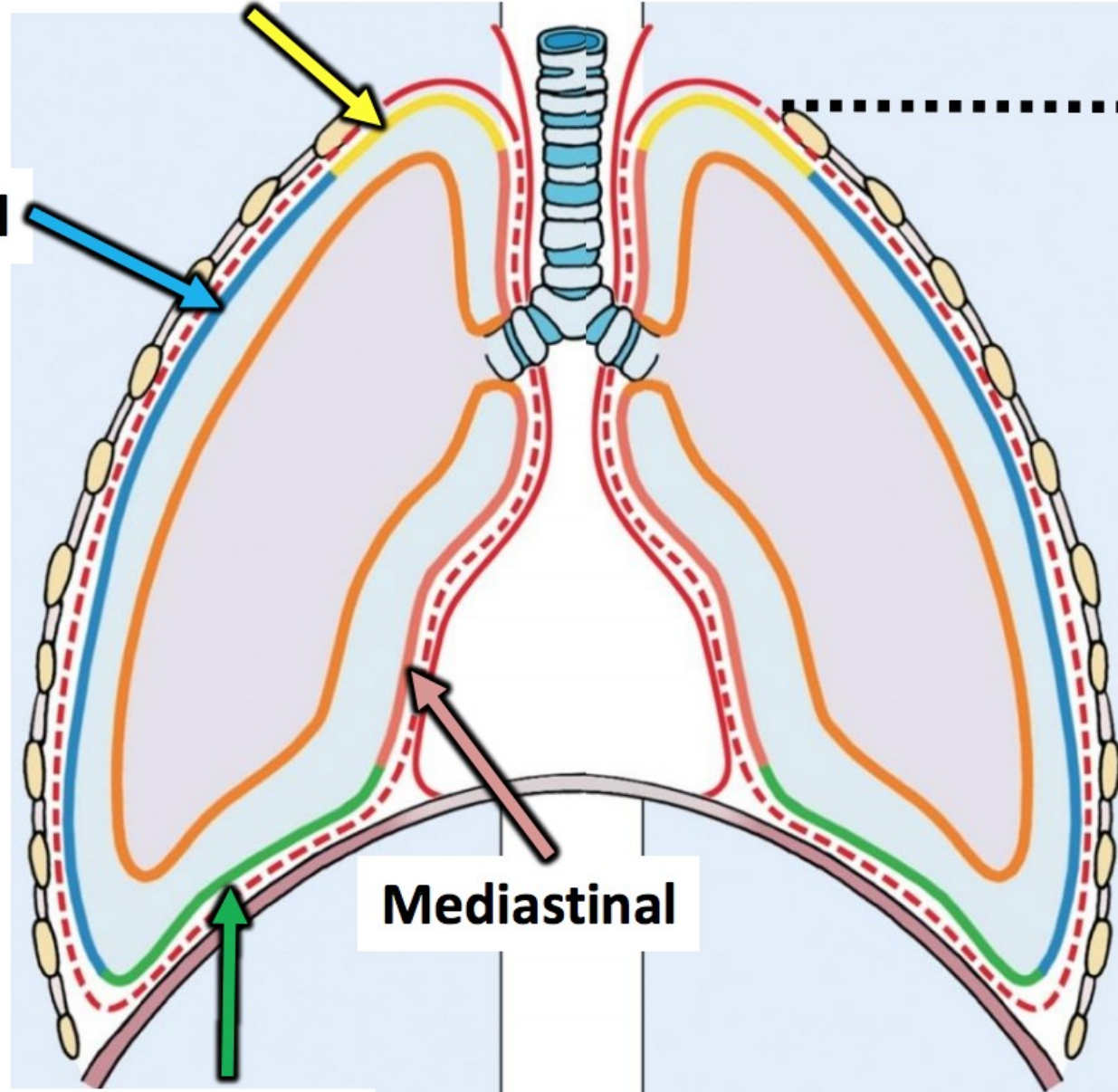
**4. Cervical part:** covers the apex of the lungs (superior to the 1<sup>st</sup> rib & Superior Thoracic Aperture)

***Injuries to the base of the neck can affect lungs and pleura because cervical pleurae extends 2 - 3 cm above the superior thoracic aperture.***

**Cervical (cupula)**

the base of the neck through the

**Costal**



**Mediastinal**

**Diaphragmatic**

# ***Pleural Recesses***



They are ***Areas of pleural cavities*** that are ***not occupied by the lungs during deep inspiration*** (two layers of parietal pleura become opposed).

The recesses also ***provide potential spaces*** in which ***fluids*** can ***collect*** and from which fluids ***can be aspirated and for*** the ***lungs*** to ***further expand*** when needed.

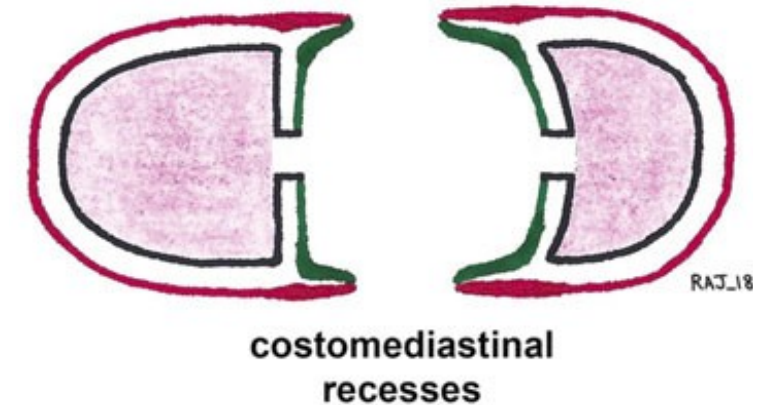
# Pleural Recesses



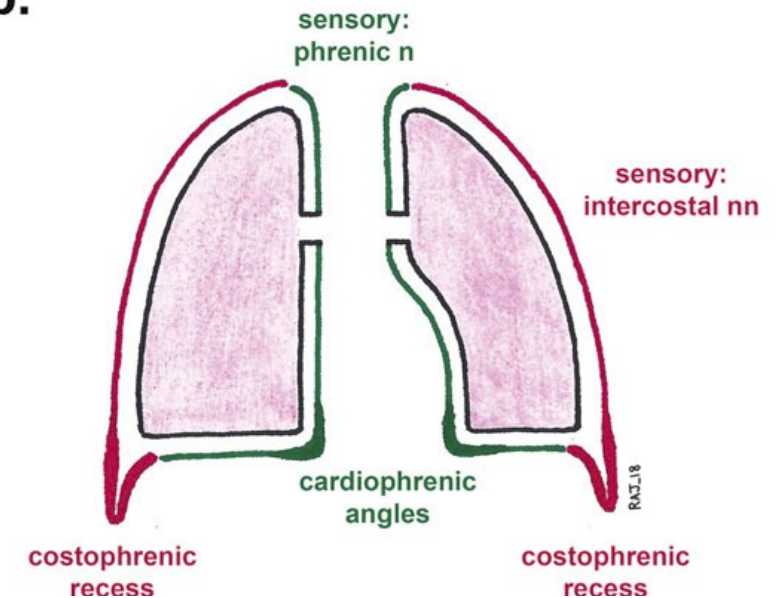
## **Costo-diaphragmatic recesses:**

Contains only pleural fluids, **(ideal site for thoracentesis).**

**Costo-mediastinal recesses:** Located posteriorly to the sternum.



b.



# Nerve Supply of the Pleura



	Parietal pleura	Visceral pleura
■ <b>Nerves</b>	<p>Somatic (<b>Intercostal nerves</b> (supply costal &amp; peripheral parts of diaphragmatic pleurae) OR Phrenic nerve (supply mediastinal &amp; central parts of diaphragmatic pleurae)</p> <p>■ Sensitive to pain</p>	<p>■ Autonomic</p> <p>■ Insensitive to pain</p>
■ <b>Arteries and veins</b>	<p>■ Intercostal, internal thoracic, musculophrenic</p>	<p>■ Bronchial vessels</p>
■ <b>Lymphatics</b>	<p>■ Parasternal, post. mediastinal and</p>	<p>■ Bronchopulmonary</p>

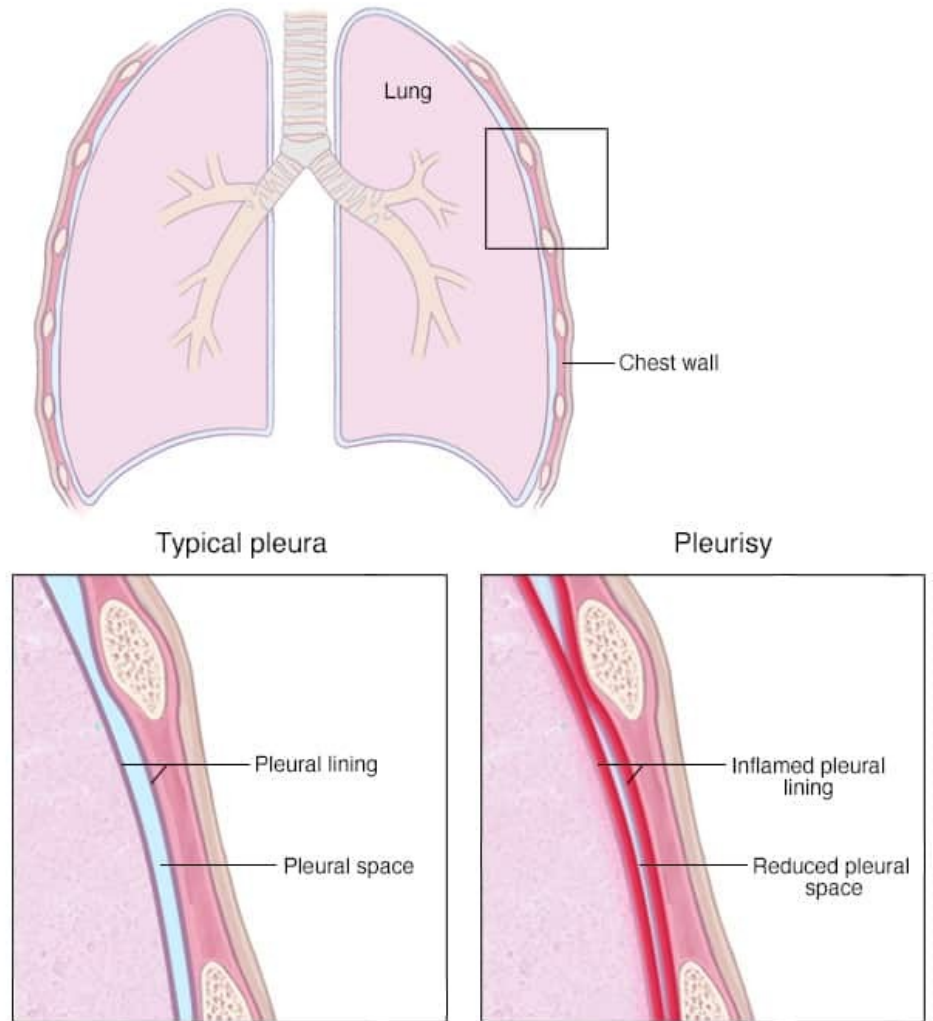
# Pleurisy



Inflammation of the parietal pleura (**pleurisy**) produces severe pain referred to:

**Thoracic & abdominal wall** (costal and peripheral part of diaphragmatic pleurae are inflamed)

**Lower neck and shoulder tip** (mediastinal and central part of the diaphragmatic pleurae are inflamed)



© MAYO FOUNDATION FOR MEDICAL EDUCATION AND RESEARCH. ALL RIGHTS RESERVED.



# ***Lecture Quiz***



- Pain referred to shoulder tip following pleurisy is due to inflammation of:
  - A. Vagus nerve
  - B. Phrenic nerve**
  - C. Intercostal nerves
  - D. Lateral pectoral nerve





# ***Anatomy of the Lungs***

# Lungs



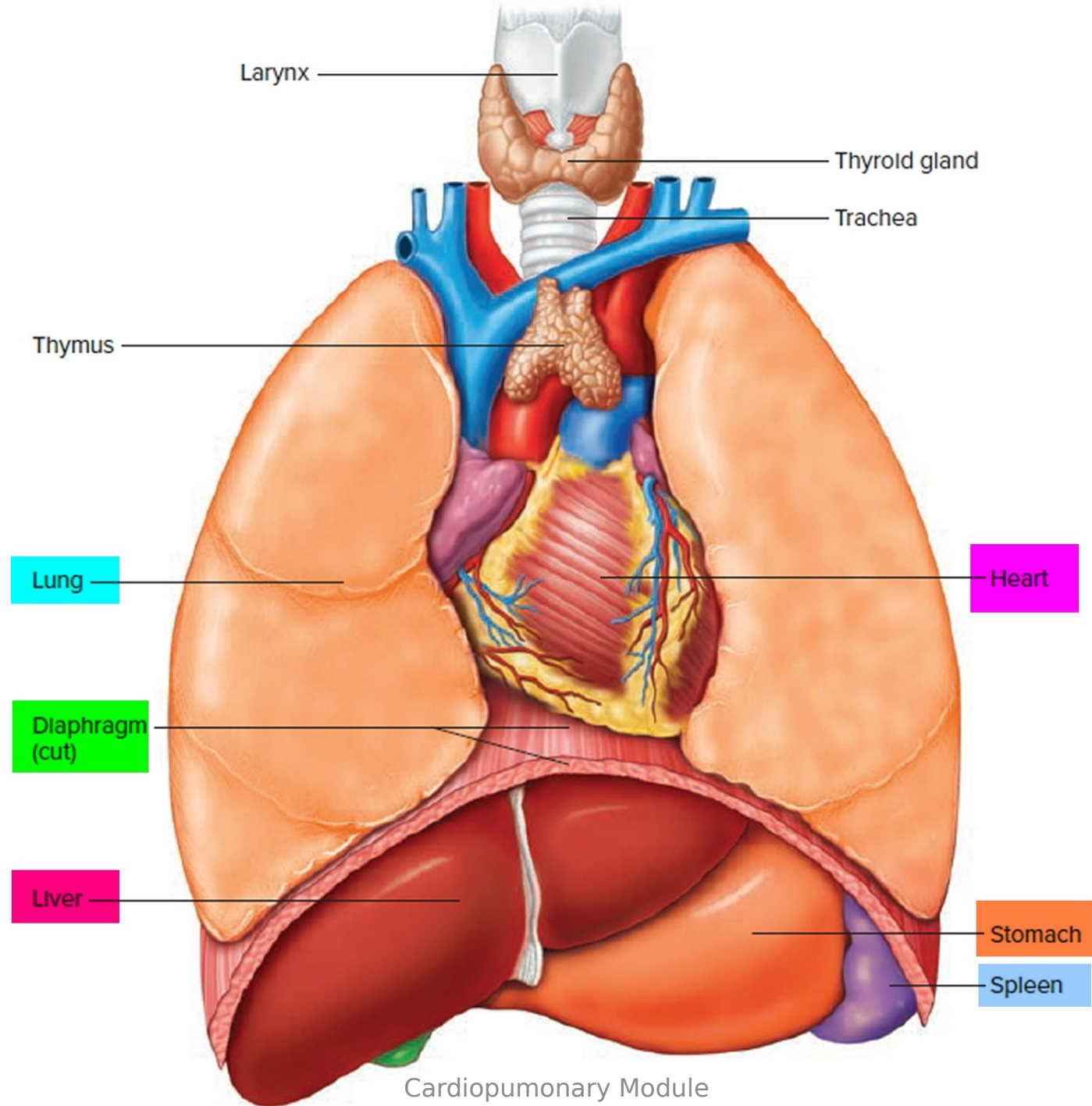
Lungs are a pair of essential respiratory organs

The lungs lie either side of the mediastinum, within the thoracic cavity.

The lungs are *soft, spongy* and *very elastic*.

In a child, lungs are *pink* in color. Gradually, they become **mottled and black** because of the deposition of inhaled carbon particles.

The right lung weighs about 700g. It is about 50- 100g heavier than the left lung.



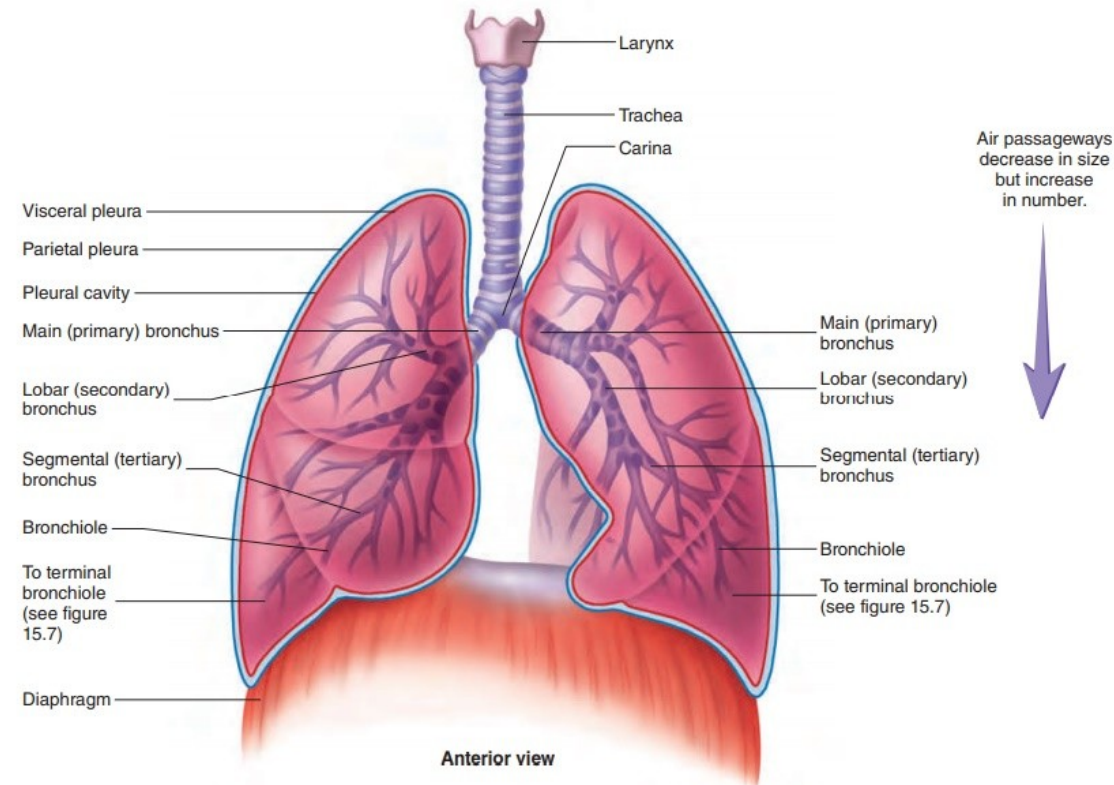
# Anatomy of the Lungs



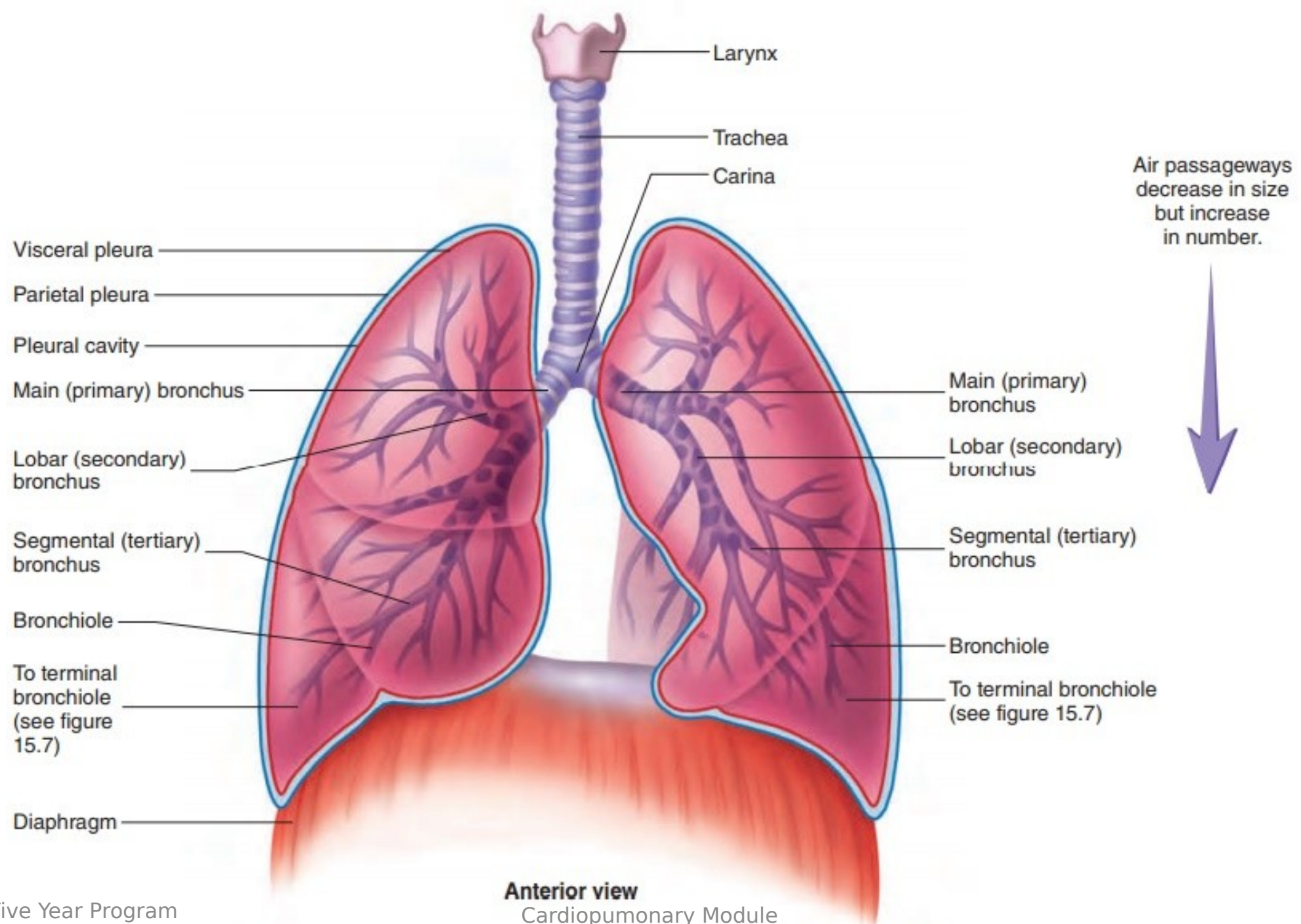
**Each lung** has conical shape with an ***apex***, ***base***, ***two surfaces*** and ***three borders***

## ***Apex***

1. Is blunt
2. Projects upward into the neck for about 1 in. (2.5 cm) above the clavicle.





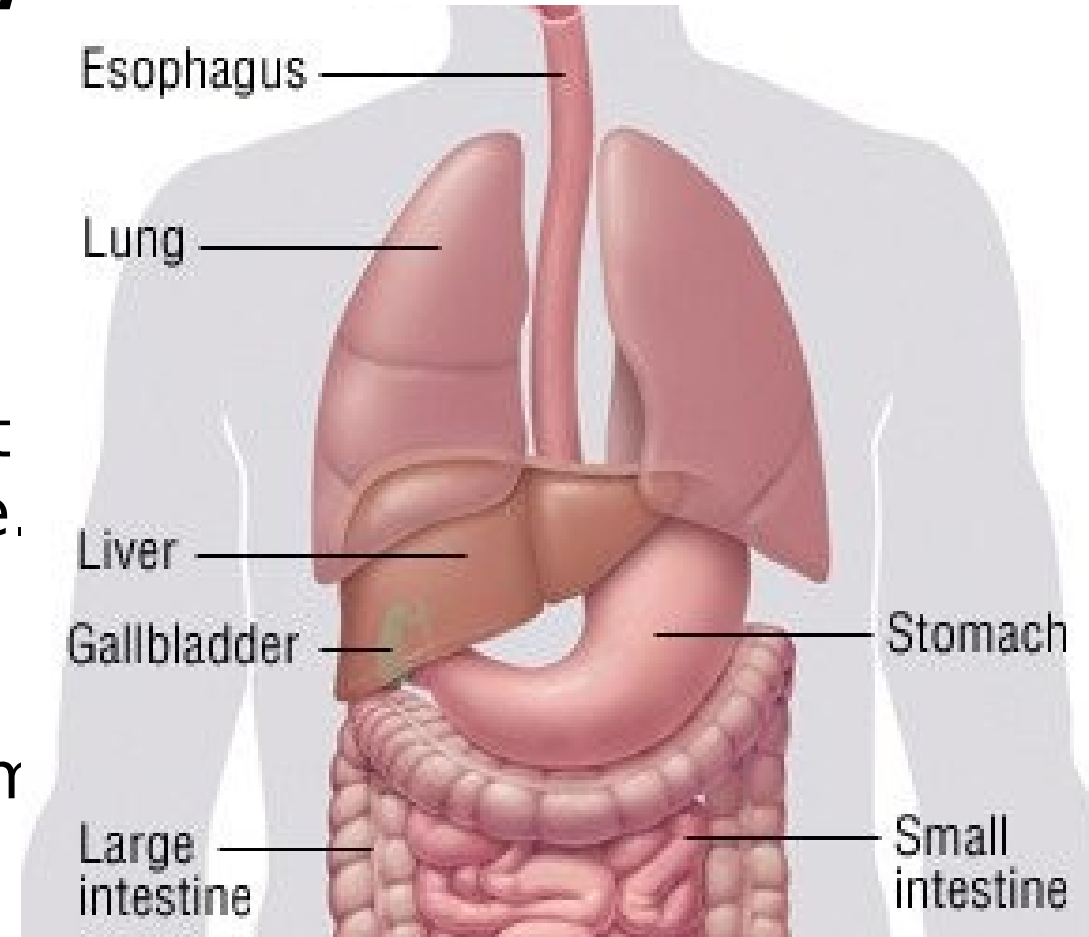


# ***Anatomy of the Lungs***



## **Base (diaphragmatic surface) that:**

1. Rests upon the upper surface of the diaphragm
2. Separated from the liver by the right dome of diaphragm on the right side.
3. Separated from the stomach and spleen by the left dome of diaphragm on the left side.



# ***Anatomy of the Lungs***



***Two surfaces*** (Costal and medial)

**The costal surface** is convex, lies immediately adjacent to the ribs and intercostal spaces of the thoracic wall.

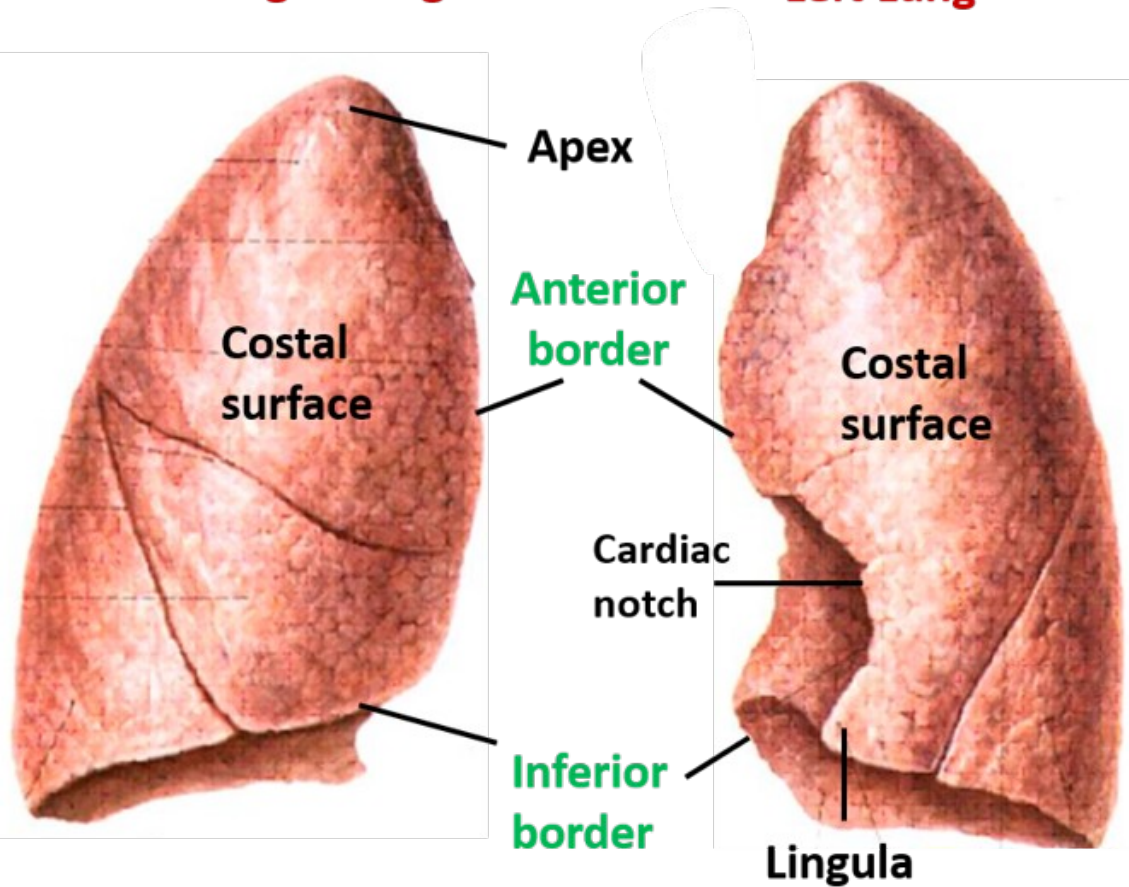
**The medial surface**, related to the mediastinum.

# ***Anatomy of the Lungs***



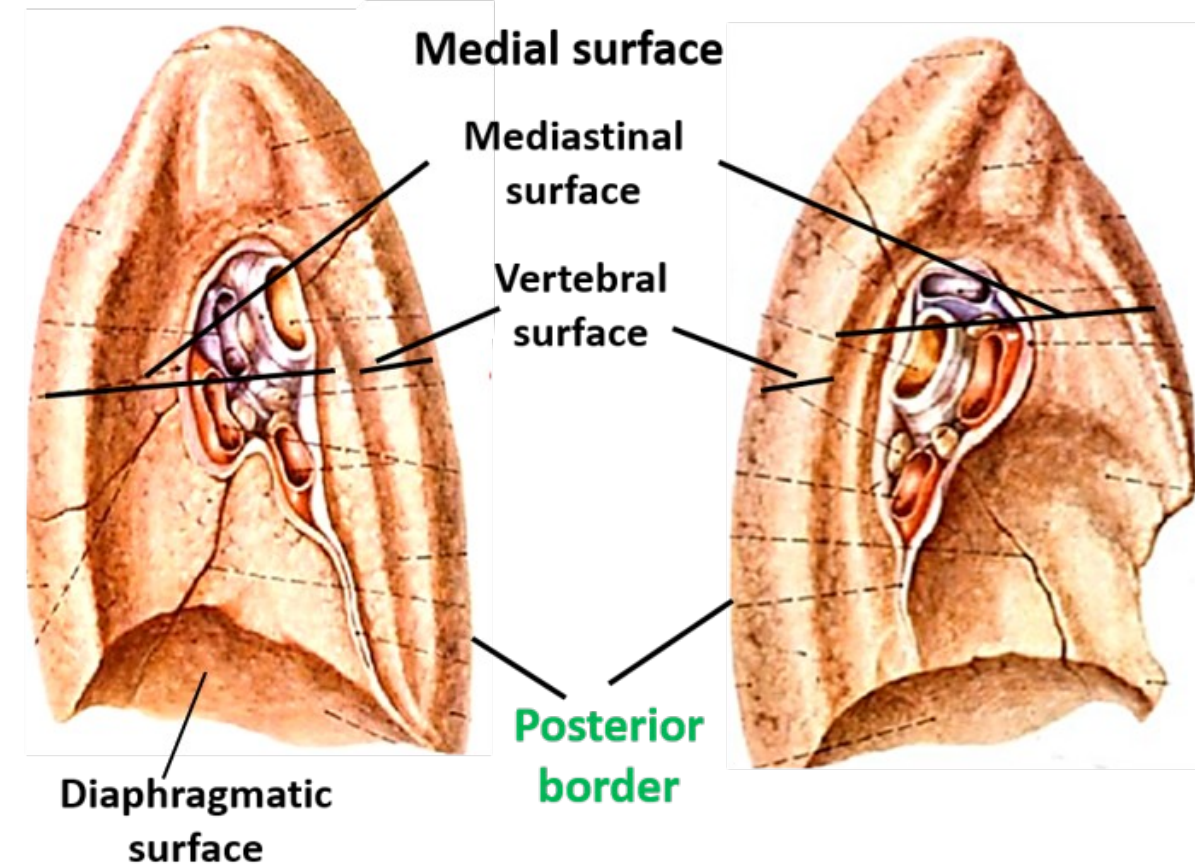
**Right Lung**

**Left Lung**



**Right Lung**

**Left Lung**



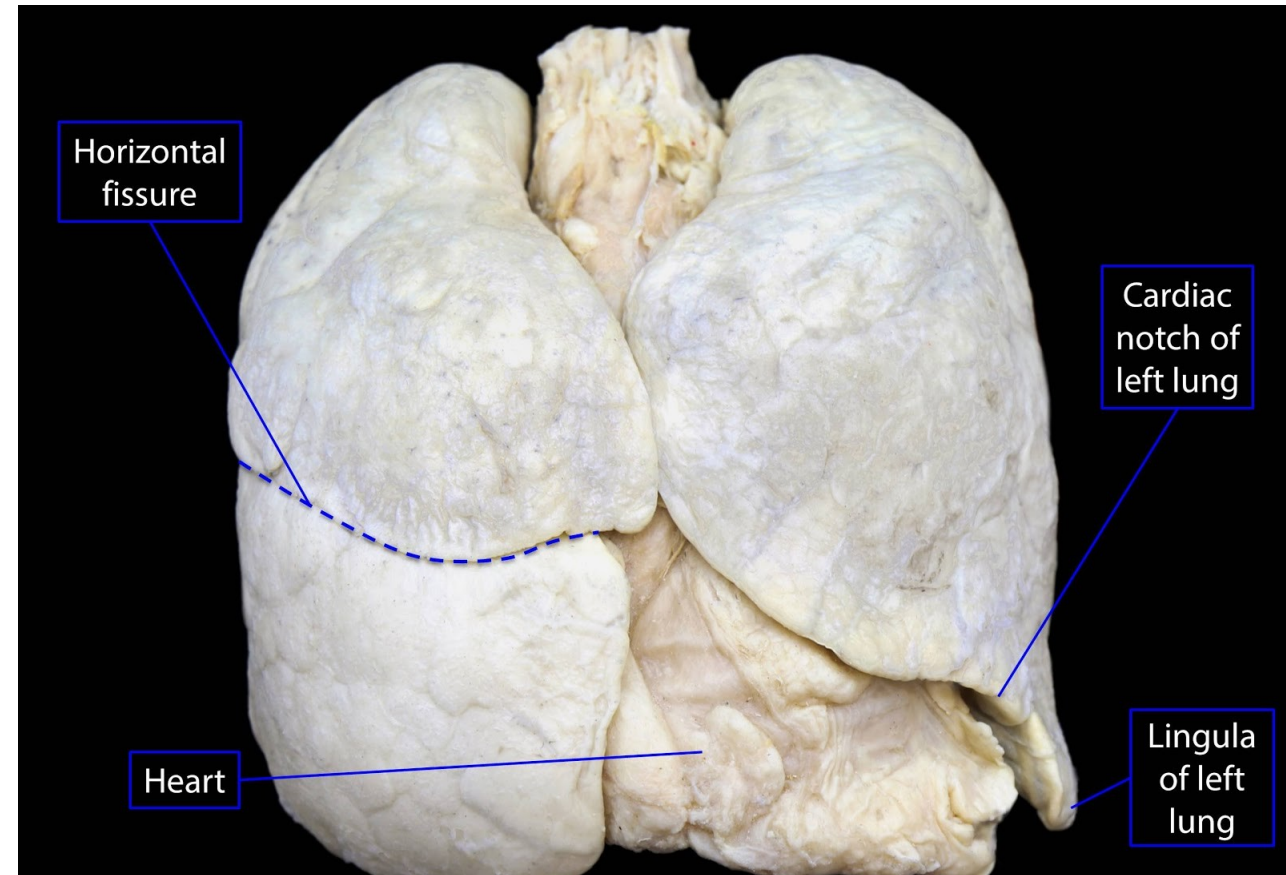


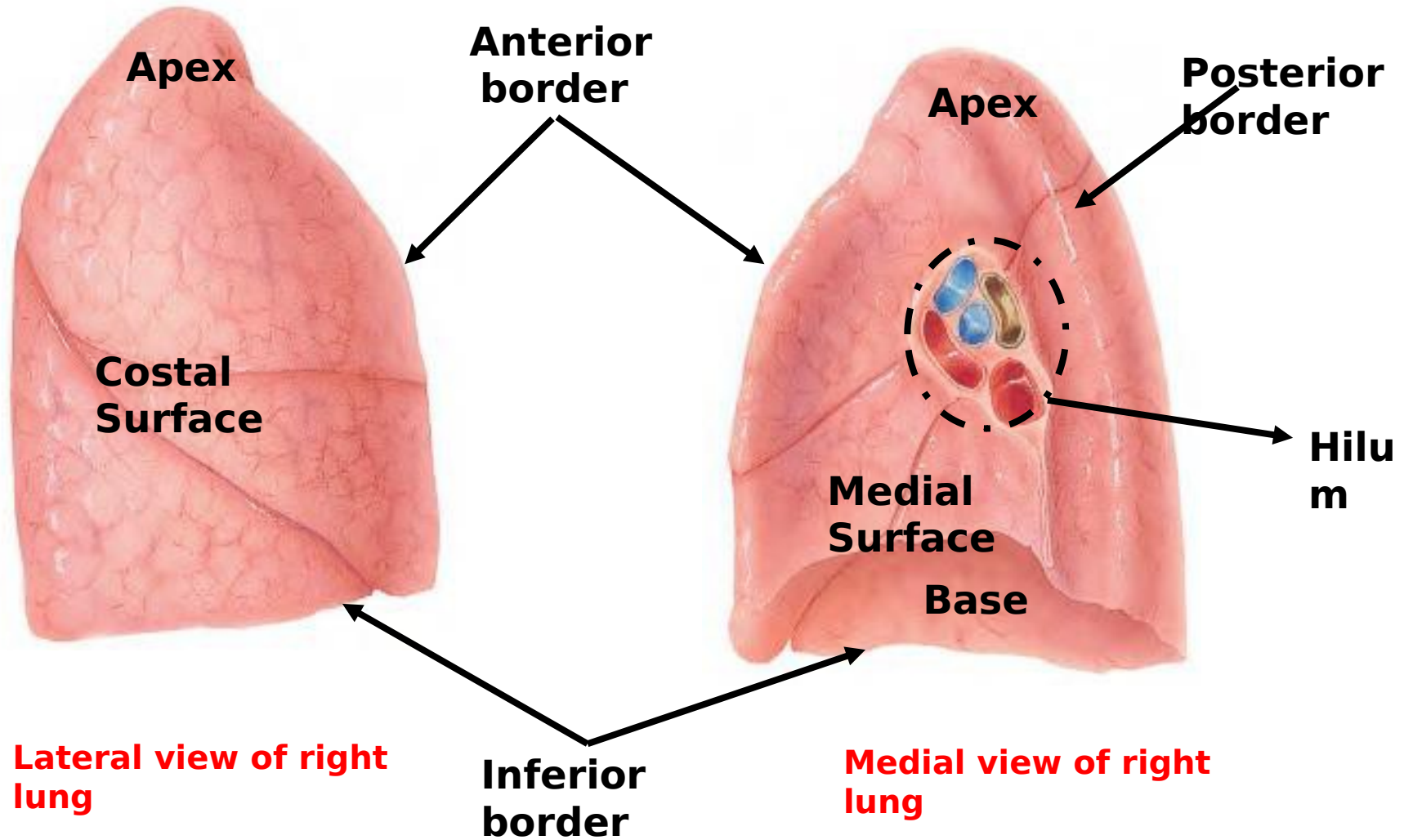
# ***Anatomy of the Lung***

## ***Three borders***

***Anterior, posterior,  
and inferior***

**Anterior border:** thin and overlaps the heart, contains a cardiac notch to the left side.





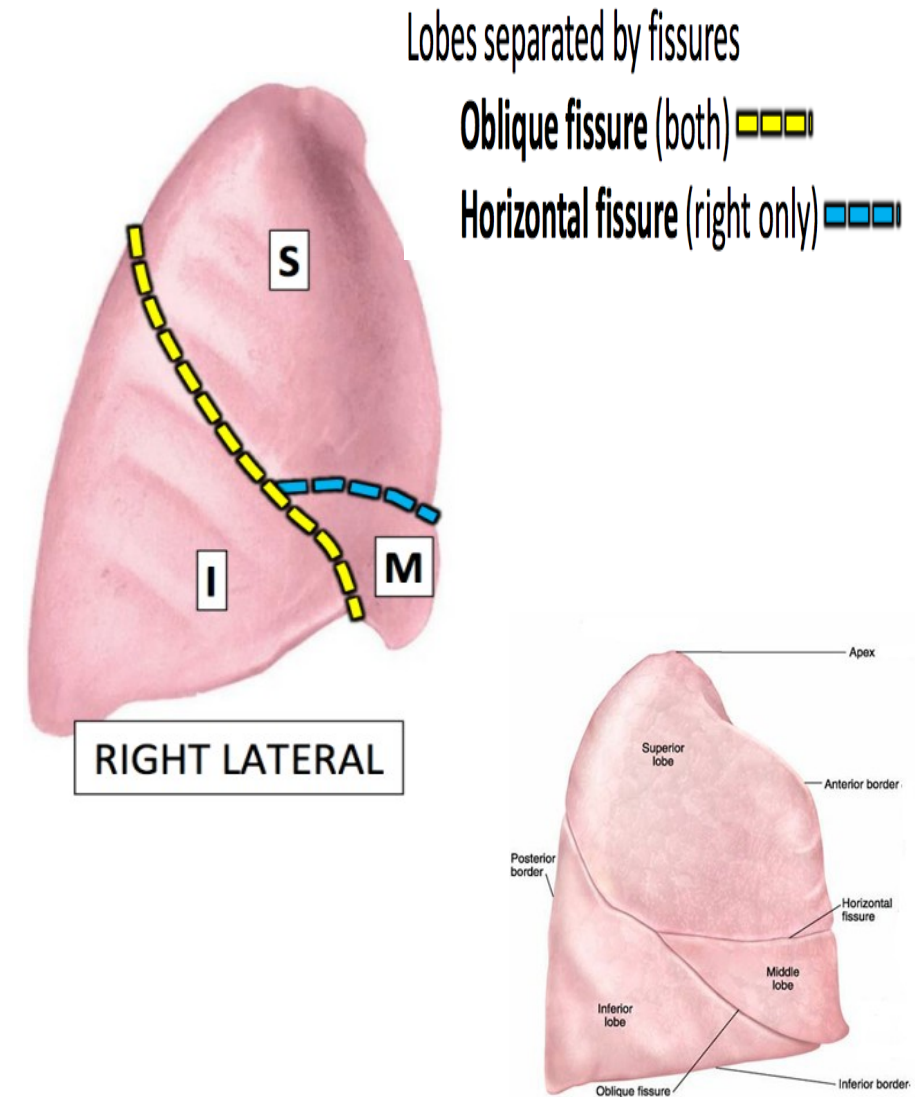
# Lung Fissures & Lobes



The right lung is slightly larger than the left lung and divided by the oblique and horizontal fissures into three lobes: **the upper, middle and lower lobes**, whereas the left lung has **2 lobes only (upper - lower)**.

**The oblique fissure (also in left lung)**

A line drawn from 3<sup>rd</sup> thoracic spine, then passes obliquely downward to **reach 6<sup>th</sup> CC.**

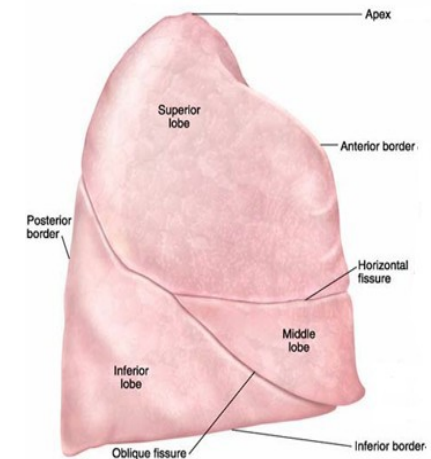
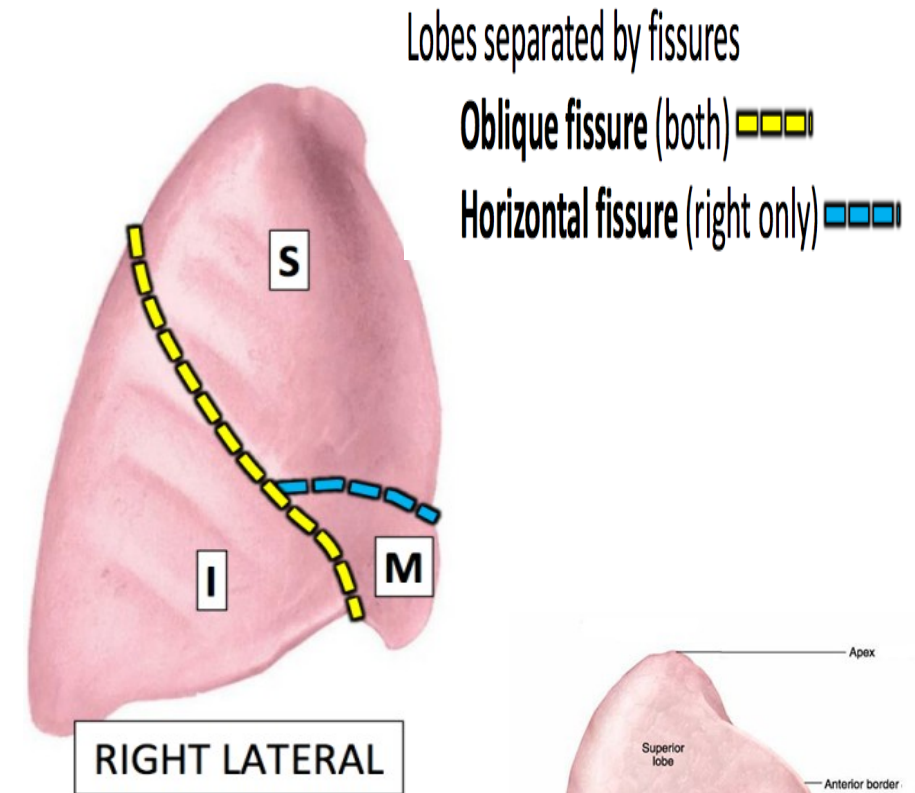


# Lung Fissures & Lobes



## The horizontal fissure

Presented by a line drawn horizontally from **middle of sternum** along **4<sup>th</sup> CC** till **meeting the oblique fissure**

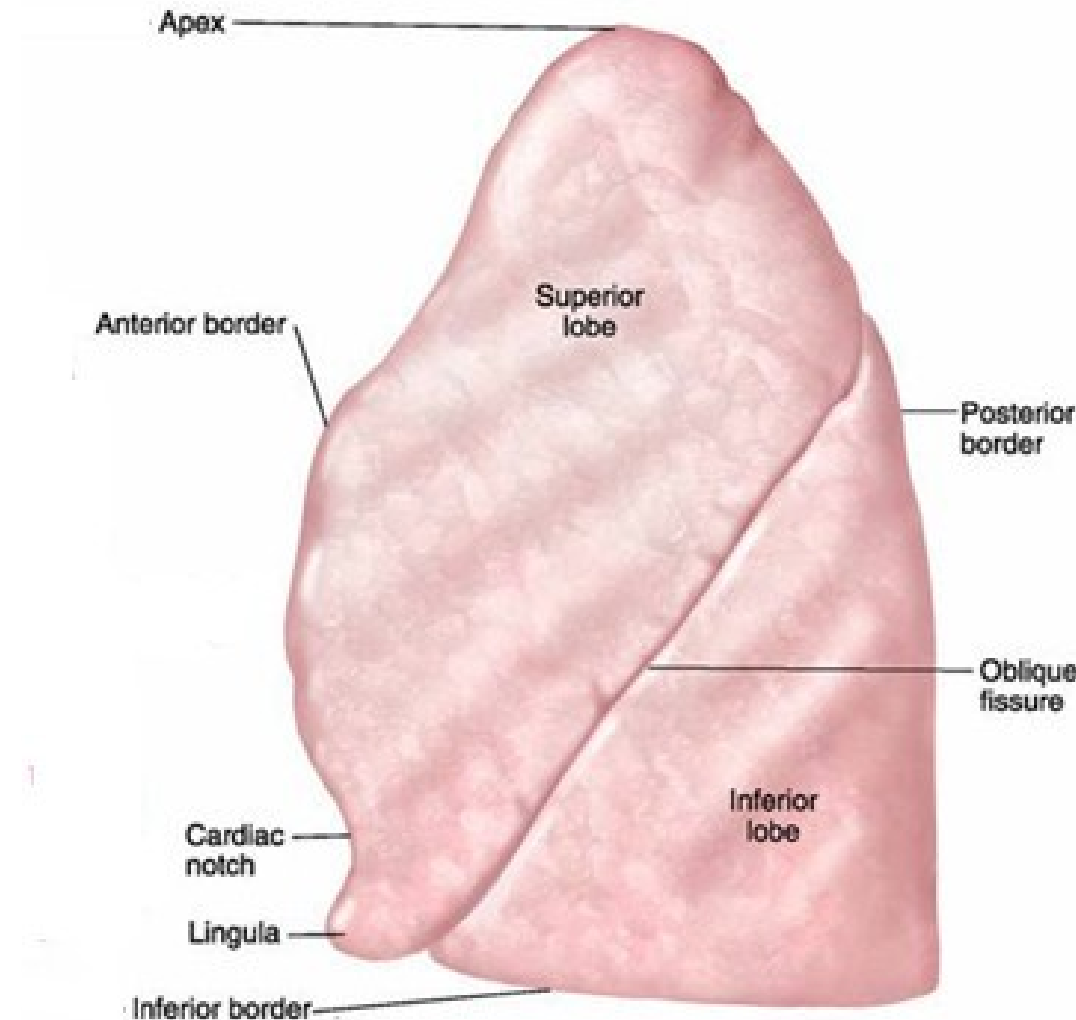


# ***Lung Fissures & Lobes***



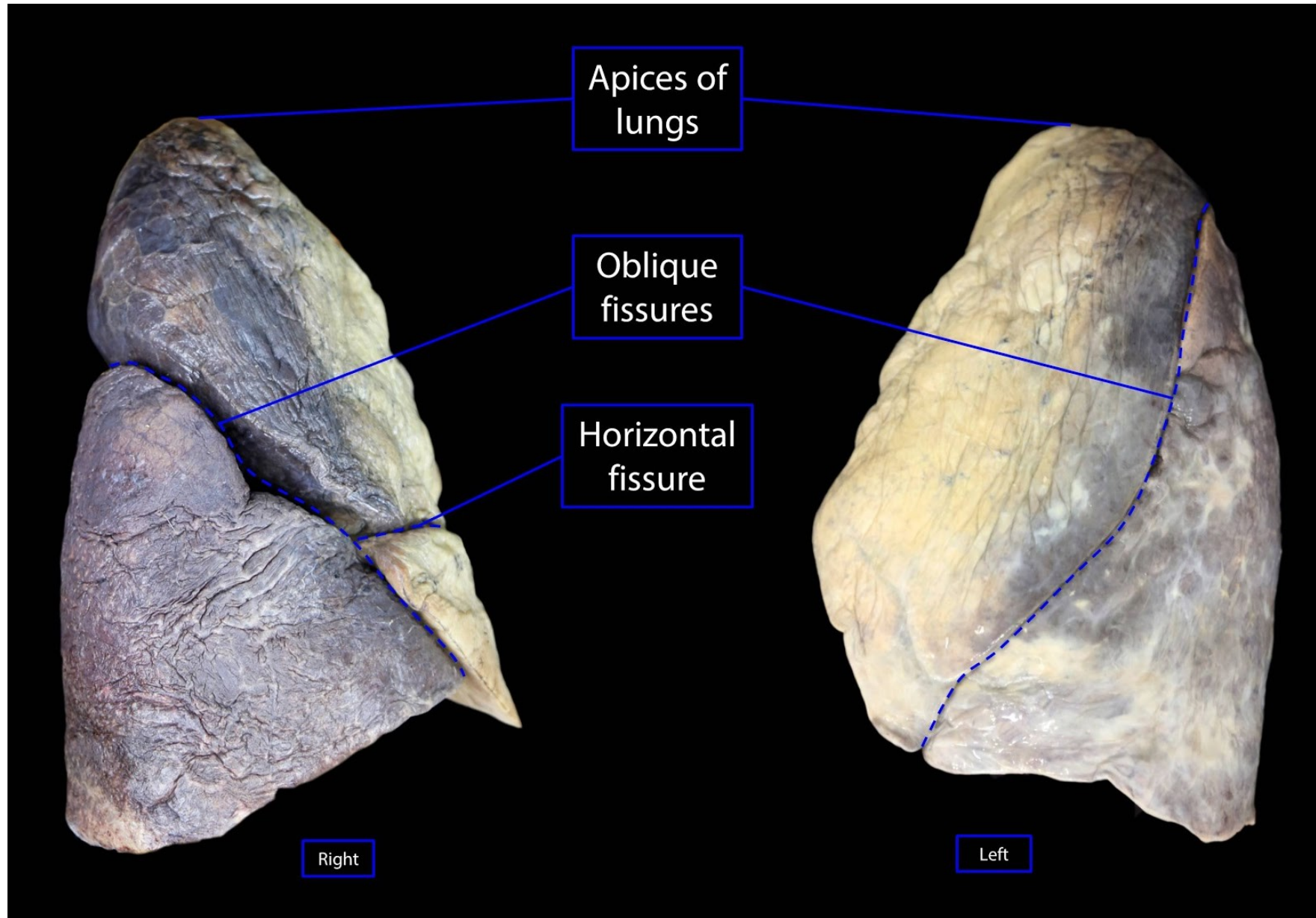
***There is no horizontal fissure in the left lung.***

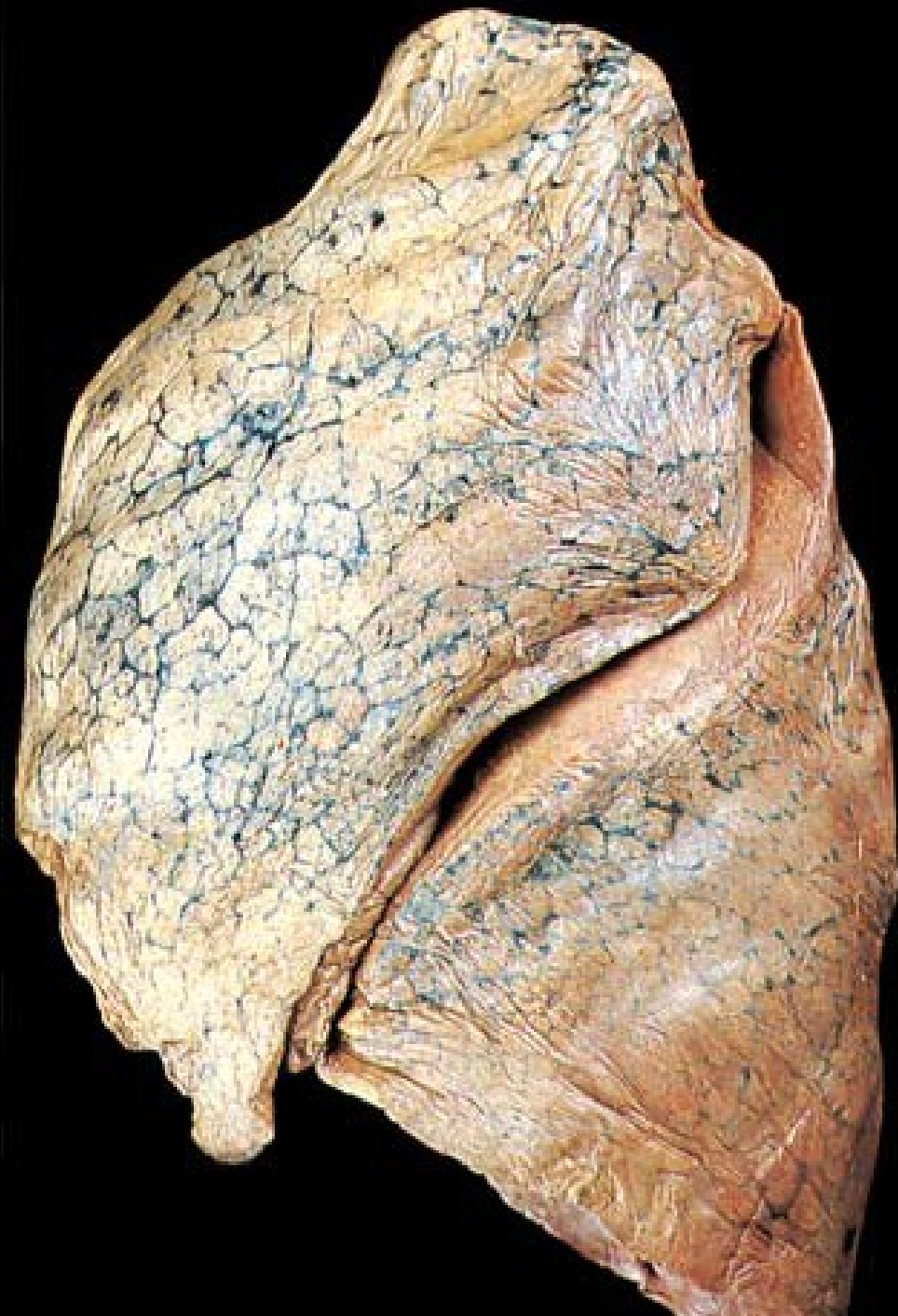
On the anterior surface of the lower part of the superior lobe a tongue-like extension (***the lingula of left lung***) projects over the heart bulge.





# ***Lobes and fissures of the Lung***





# ***Root and Hilum of the Lung***



Lung roots lie opposite to **T5-T7** vertebrae.

The structures in the root are embedded in the C.T and surrounded by extension of **mediastinal pleura**.

**The hilum** is the area through which the structures enters or leaves the lung



# ***Root and Hilum of the Lung***



**The root** of each lung consists of structures passing to and from the lung to mediastinum. These **structures are:**

**Pulmonary arteries.**

**Pulmonary veins (Sup & Inf)**

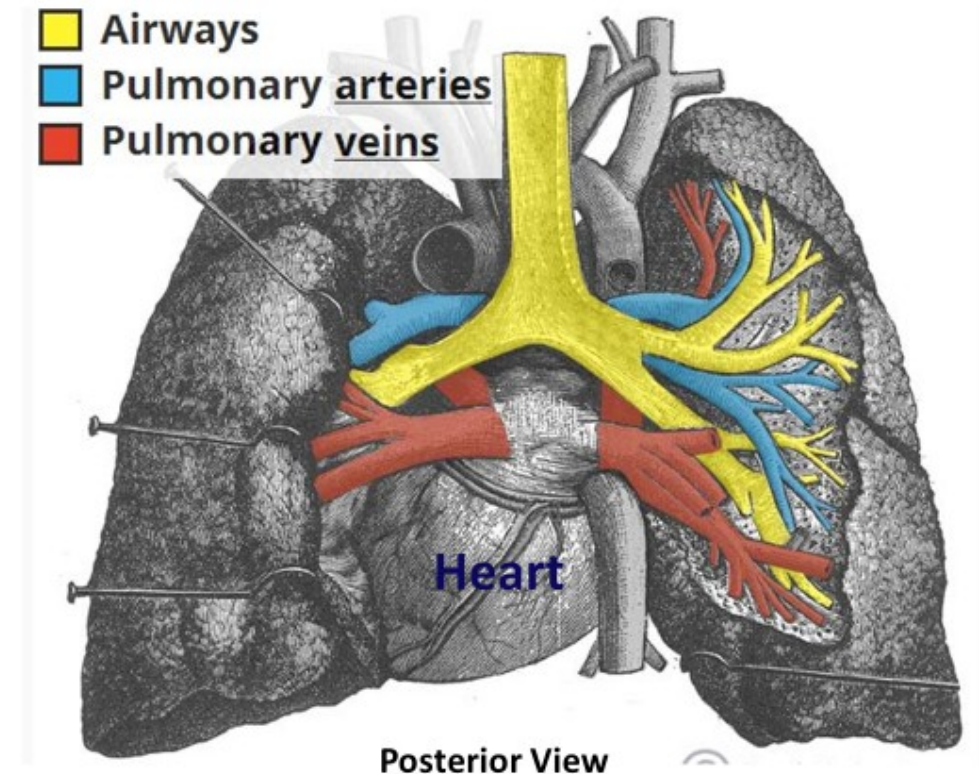
**A main bronchus.**

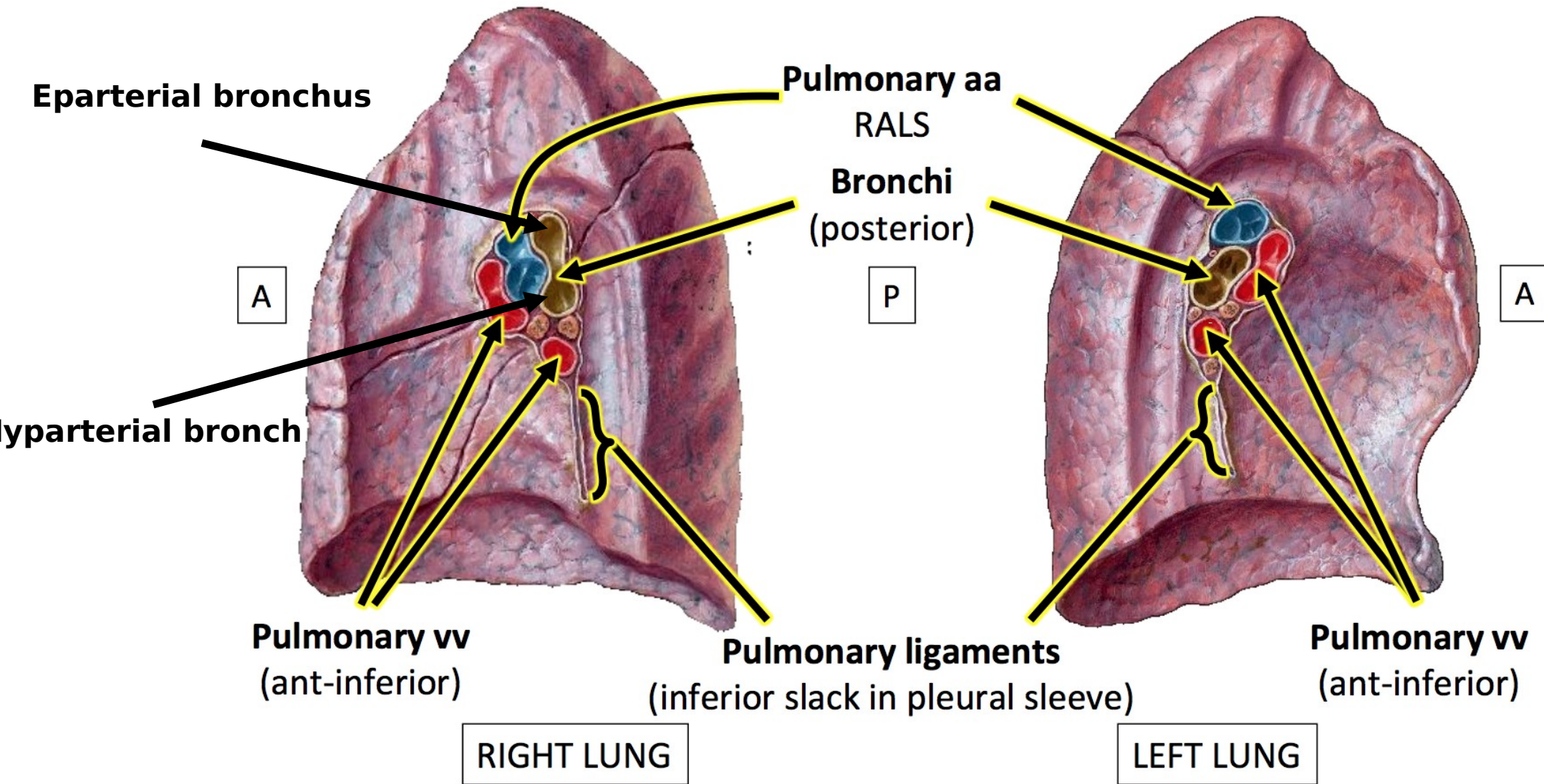
**Minor contents:**

**Bronchial vessels.**

**Nerves and lymphatics.**

**Ant, post pulmonary plexus**



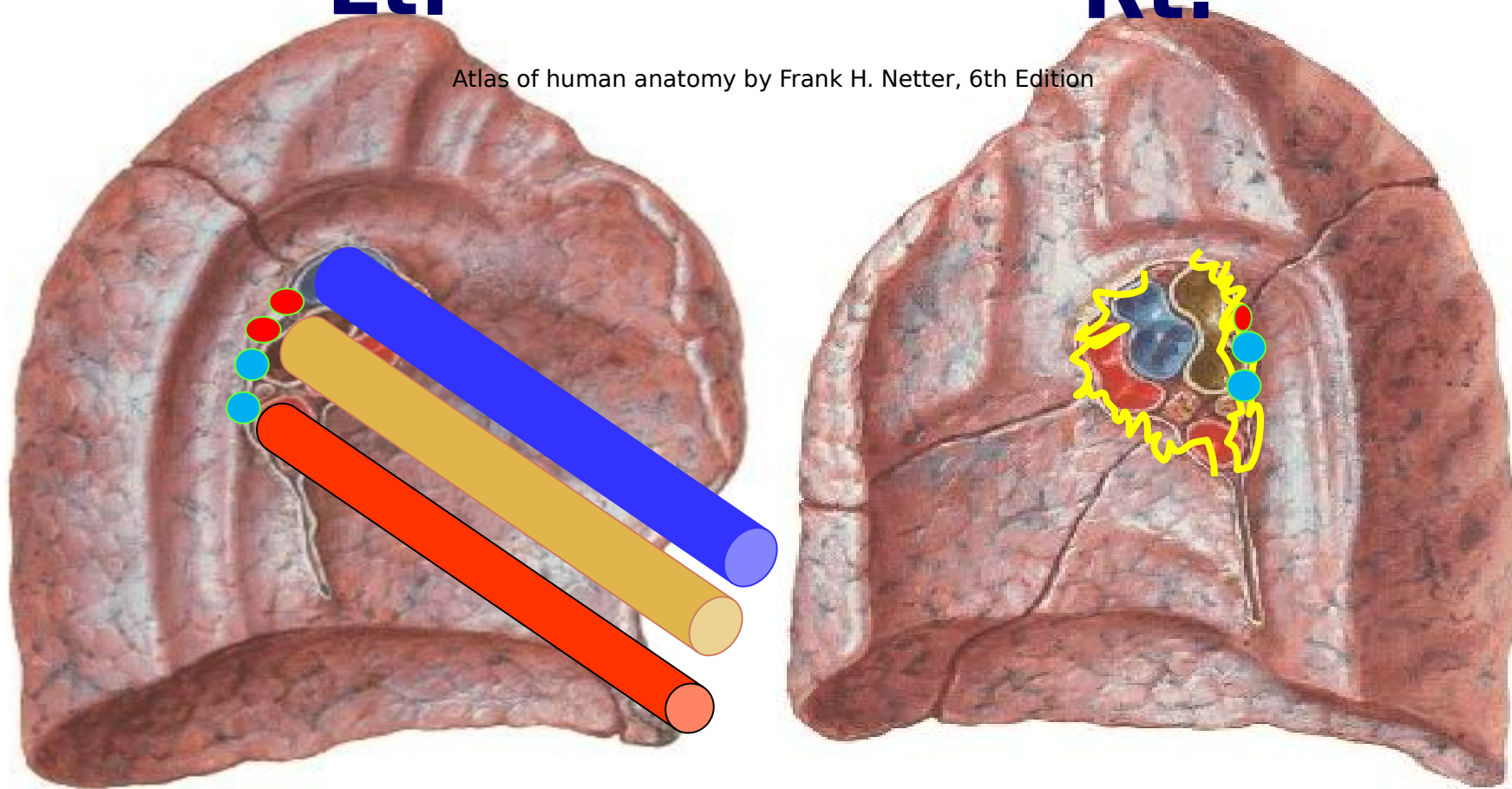


**On the right side, the lobar bronchus to the superior lobe branches from the main bronchus in the root, unlike on the left where it branches within the lung itself, and is superior to the pulmonary artery**

**Lt.**

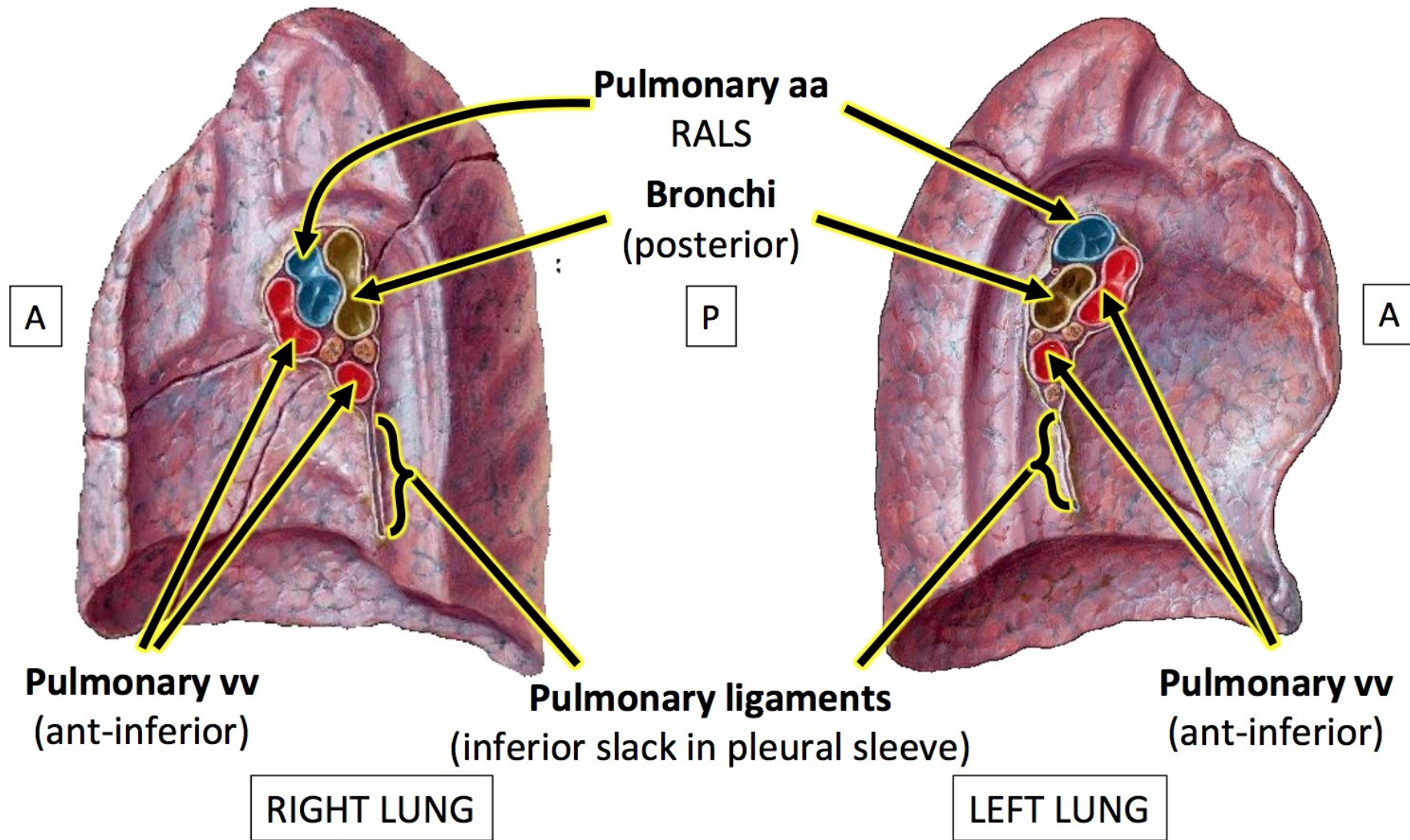
**Rt.**

Atlas of human anatomy by Frank H. Netter, 6th Edition

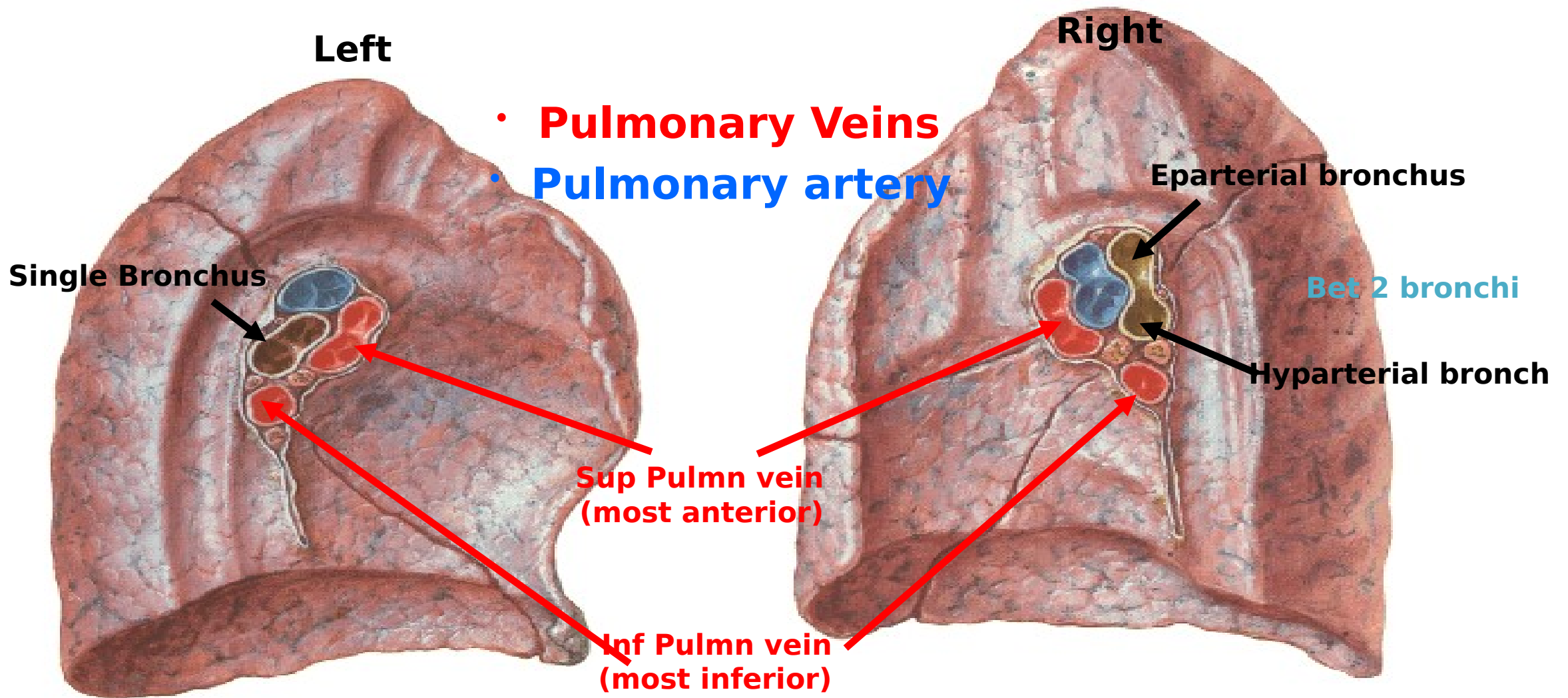


- **The bronchial arteries** 2 in Lt lung (from desc. aorta) & 1 in Rt lung (from Lt sup bronchial or 3rd Rt post intercostal)
- **The bronchial veins** 2 on each side join azygos vein (Rt lung) & hemiazygos or left superior intercostal vein (Lt lung).





**Generally, the pulmonary artery is superior at the hilum, the pulmonary veins are inferior, and the bronchi are somewhat posterior in position.**



# Blood Supply and Lymphatics



Bronchial **arteries** & **Veins**

**Bronchopulmonary lymph nodes**

**Nerve Supply**

**From Ant. & Post. Pulmonary plexuses**

**Parasympathetic:**

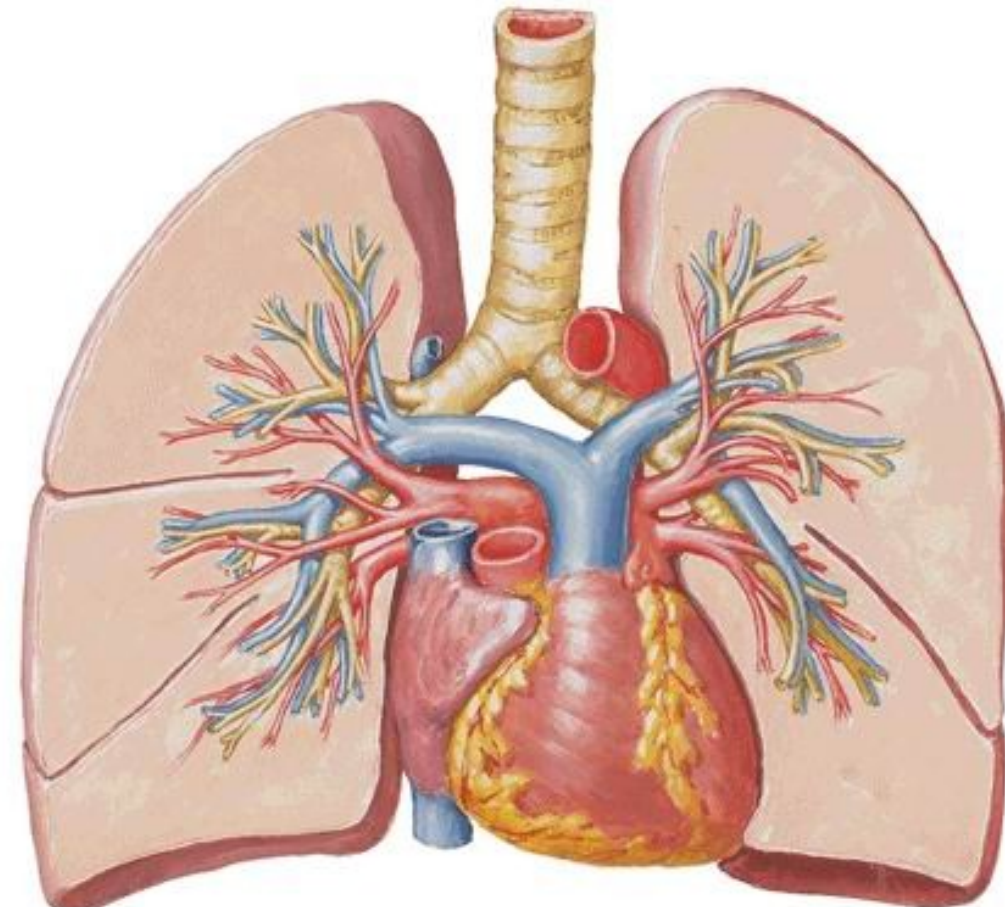
*Smooth ms of bronchial tree (bronchoconstriction)*

*Glands (secretomotor)*

**Sympathetic:**

*Smooth muscles of bronchial tree (bronchodilatation)*

*Vasomotor to blood vessels*



Atlas of human anatomy by Frank H. Netter, 6th Edition

# Bronchopulmonary Segments

Definition : A bronchopulmonary segment is the area of lung supplied by a segmental bronchus and its accompanying pulmonary artery branch. *They are separate anatomical, functional and surgical units of the lung*

## *Characteristic features:*

1. Each bronchopulmonary segments is *pyramidal* in shape the apex directed toward the hilum base projected peripherally onto the surface of the lung.
2. Segmental bronchus with bronchial vessels and branch of pulmonary artery accompanying it are central in position.
3. *Bronchopulmonary segment is the smallest, functionally independent region of a lung and the smallest area of lung **that can be isolated and removed without affecting adjacent regions**.*

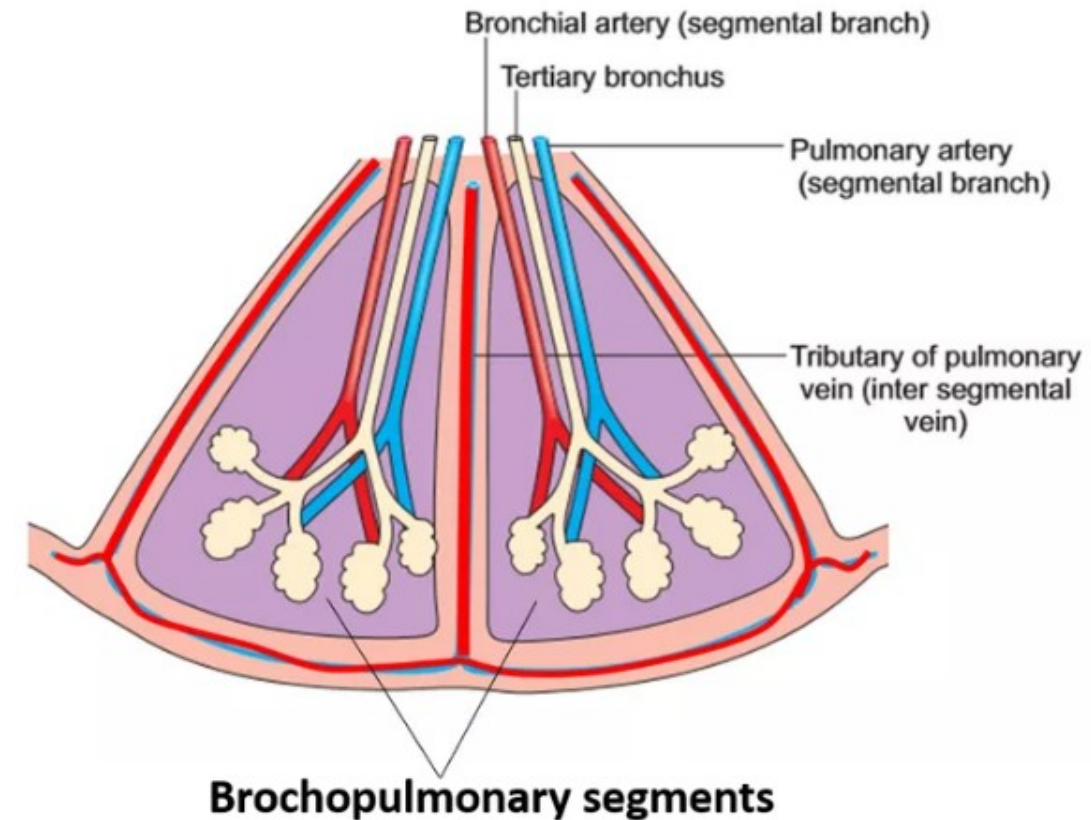


# ***Bronchopulmonary Segments (10 in each lung)***



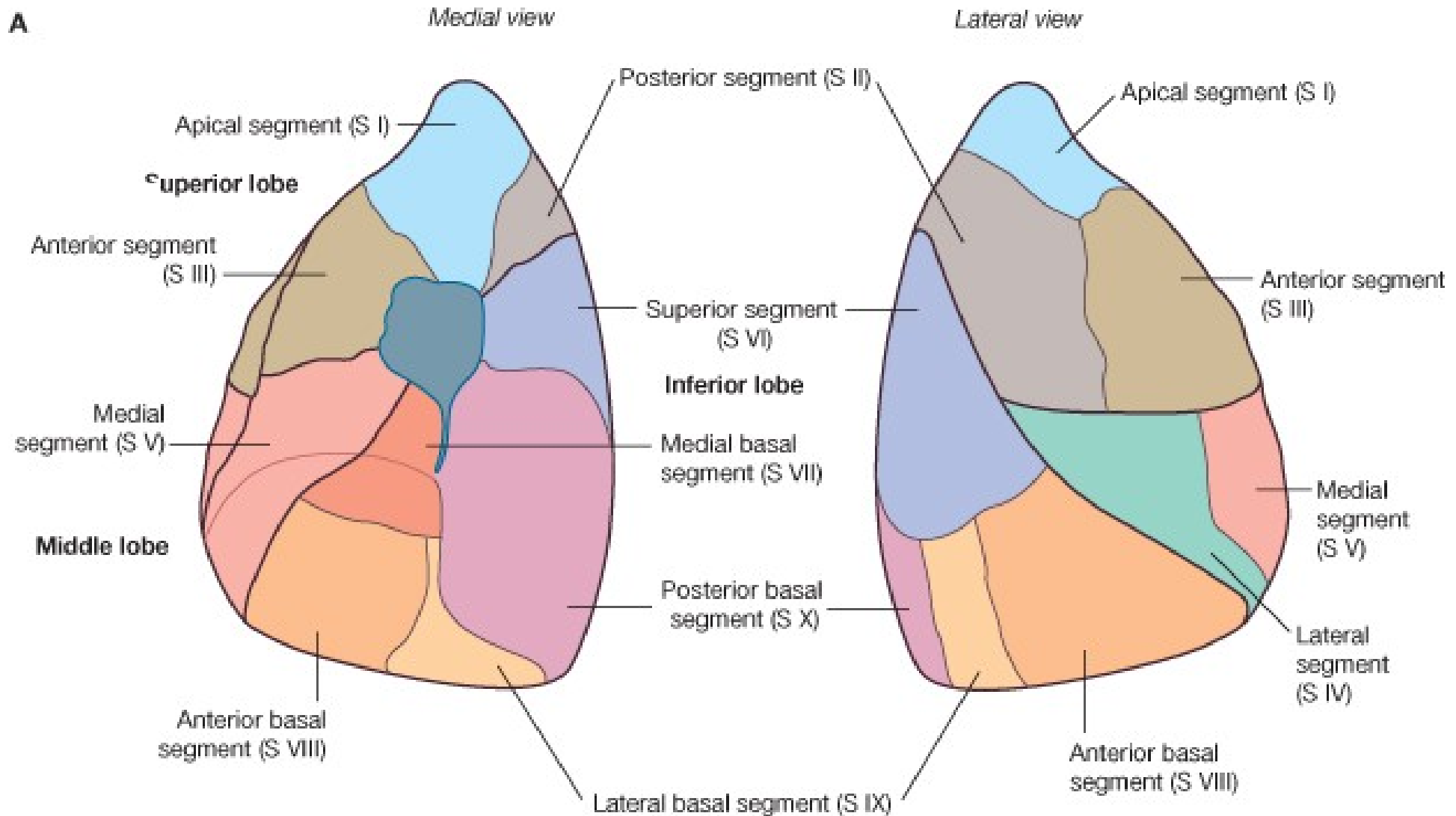
A diseased bronchopulmonary segment can be resected (segmentectomy) without interrupting neighboring segments.

Similarly, an entire lobe (lobectomy) or lung (pneumonectomy) can be resected.

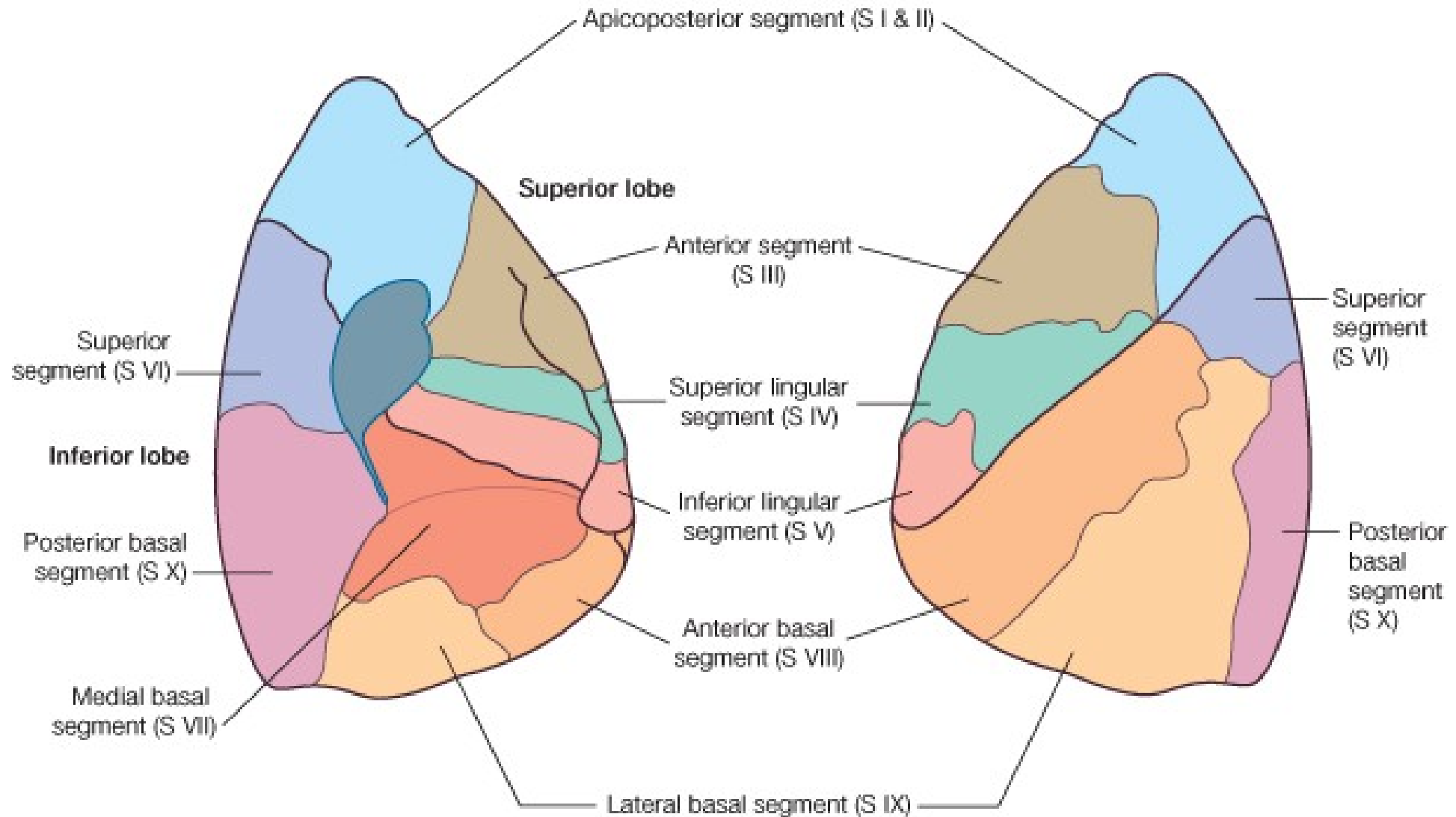




**A**

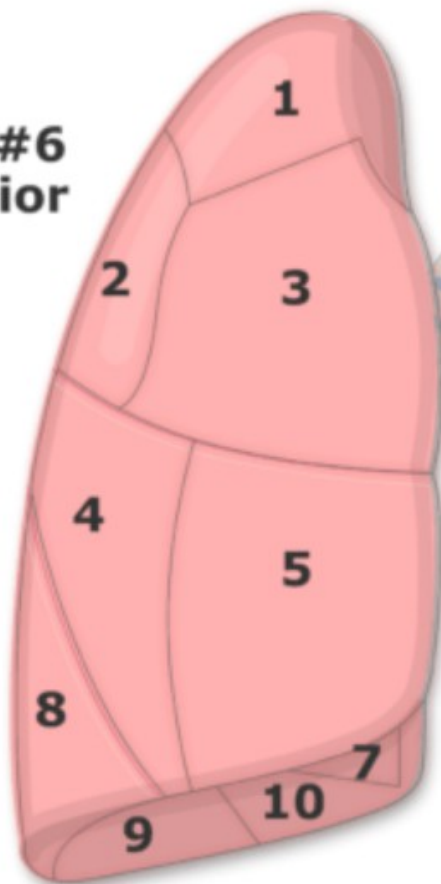


# ***Right Bronchopulmonary Segment***

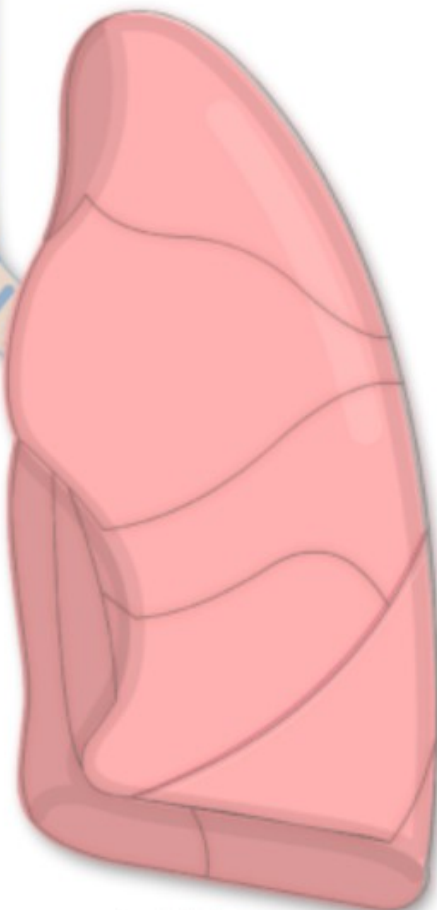
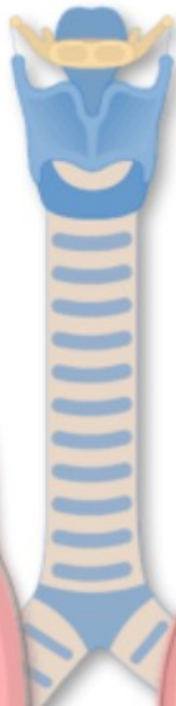


# ***Left Bronchopulmonary Segment***

**Segment #6  
on posterior**

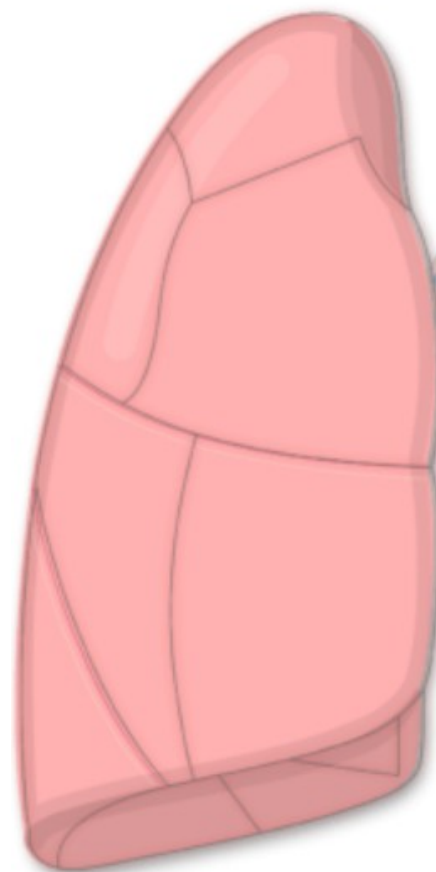


**Right Lung**

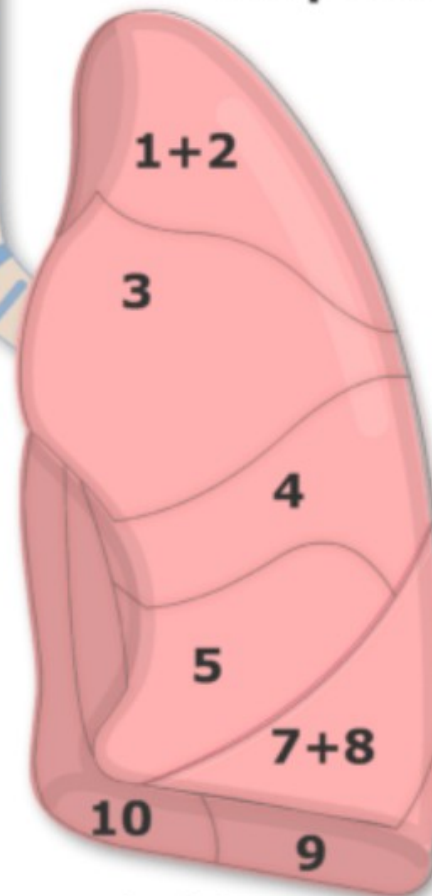


**Left Lung**

**Segment #6  
on posterior**



**Right Lung**



**Left Lung**

# ***Lecture Quiz***



- **Enumerate & arrange major contents of the root of left lung**

**1. Bronchus**

**2. Pulmonary artery**

**3. 2 pulmonary veins (Sup and Inf)**



# ***Lung Surface Anatomy***

# ***Right Lung Surface Anatomy***



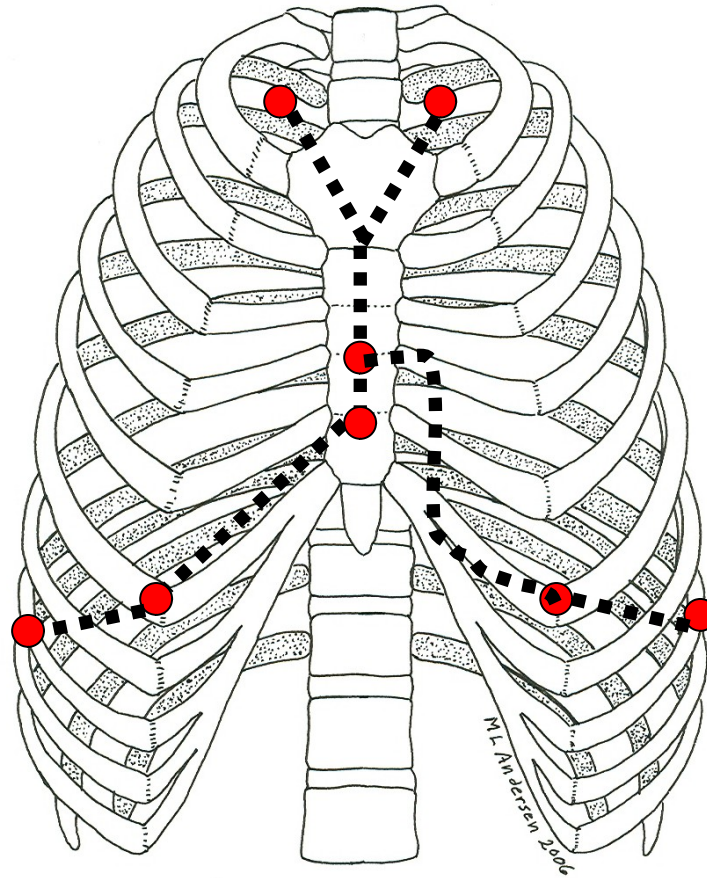
- Apex is represented by a curved line 1 inch above medial 3<sup>rd</sup> of clavicle and 1<sup>st</sup> rib towards sternoclavicular joint.
- From sternoclavicular joint to median plane at sternal angle.
- Leaves sternum at 5<sup>th</sup> costal cartilage for the right side.
- At 6<sup>th</sup> rib at midclavicular line.
- At 8<sup>th</sup> rib at midaxillary line.
- At 10<sup>th</sup> rib at scapular line.
- Ends opposite T10 by ascending towards the apex again.

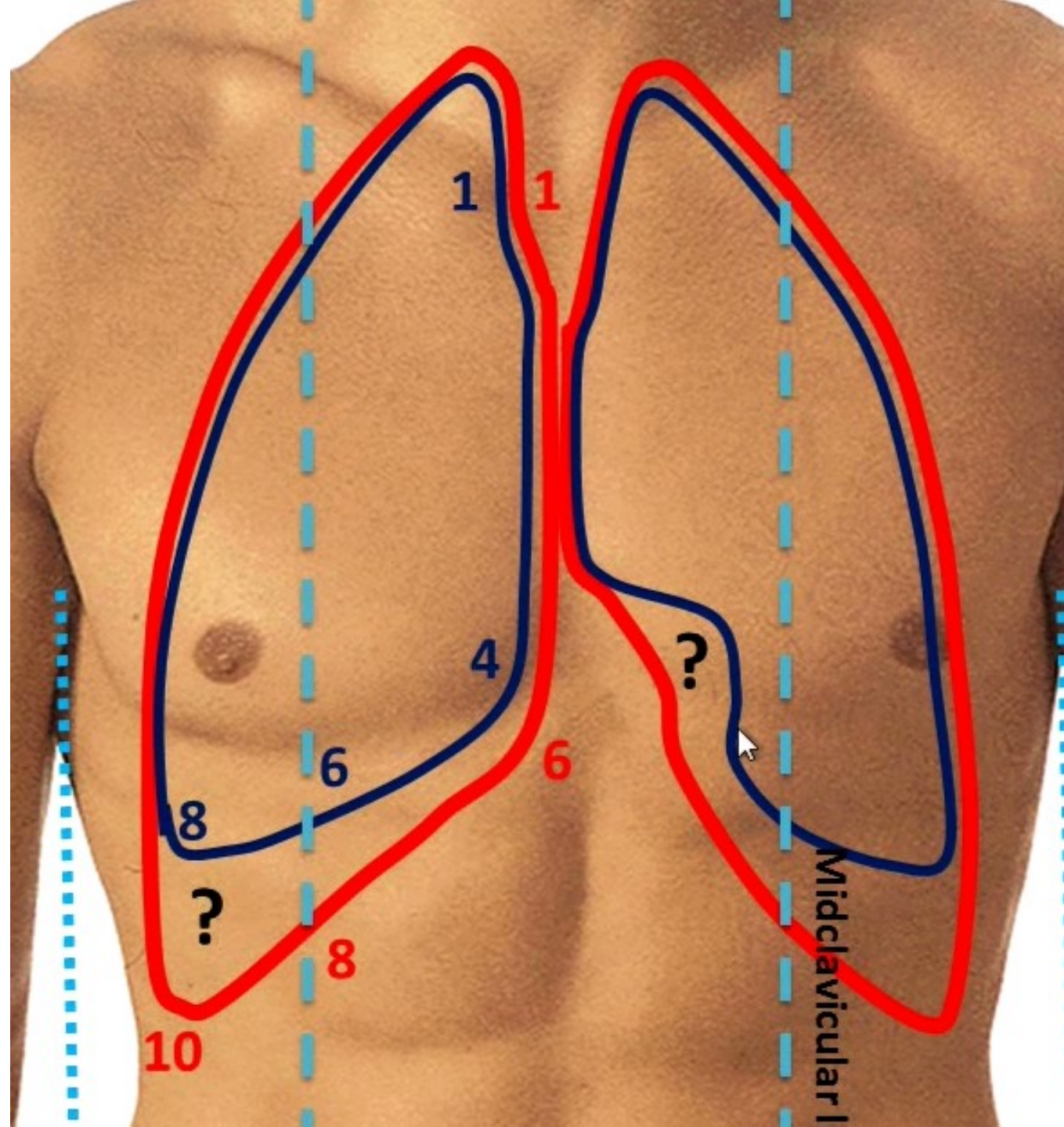


# ***Left Lung Surface Anatomy***



- ***Same as right lung except:***
- Cardiac notch begins at 4<sup>th</sup> costal cartilage.
- Horizontal till parasternal line.
- Descends vertically till costochondral junction of the 6<sup>th</sup> costal cartilage and completes like the right lung.





# ***Pleural Surface Anatomy***



- ***Cervical dome of pleura:***

Level with neck of the first rib. Anteriorly, 1.5-2.5 cm above the sternal end of the clavicle.

Anterior margin extends obliquely behind the sternoclavicular joint.

- ***At sternal angle***, the pleura is at the median line and two sides stay in contact until the 4<sup>th</sup> costal cartilage.

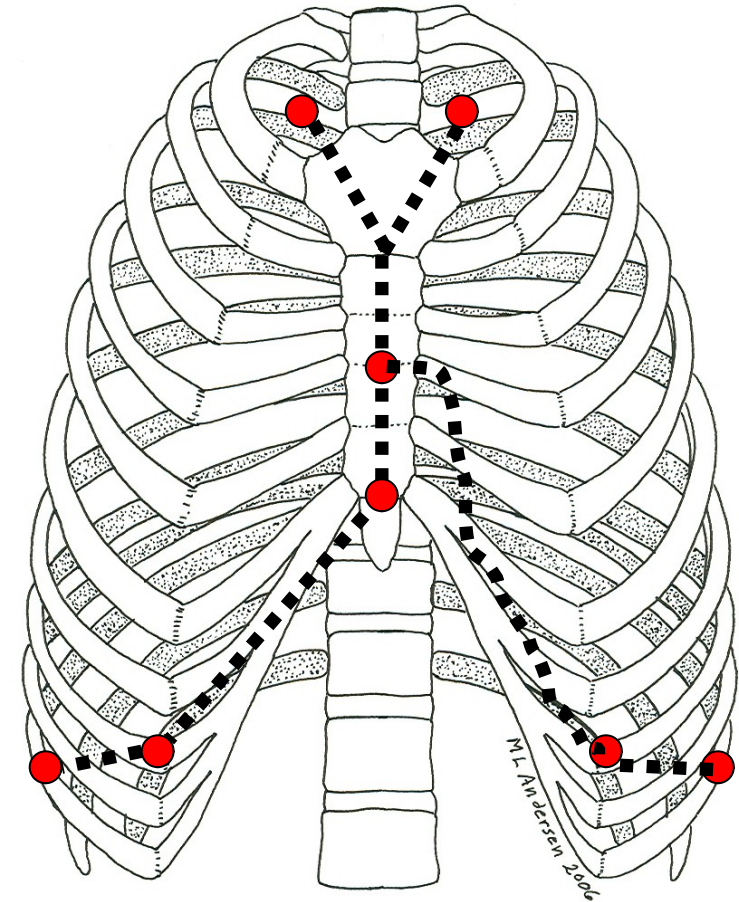
- ***At this level, the left pleural margin shifts to the left side and descends till the 6<sup>th</sup> costal cartilage***

# ***Pleural Surface Anatomy***



- ***Right side:***

- Leaves sternum at 6<sup>th</sup> costal cartilage.
- At 8<sup>th</sup> costal cartilage at midclavicular line.
- At 10<sup>th</sup> rib at midaxillary line.
- Extends to level of body of T12 and then ascends upward.



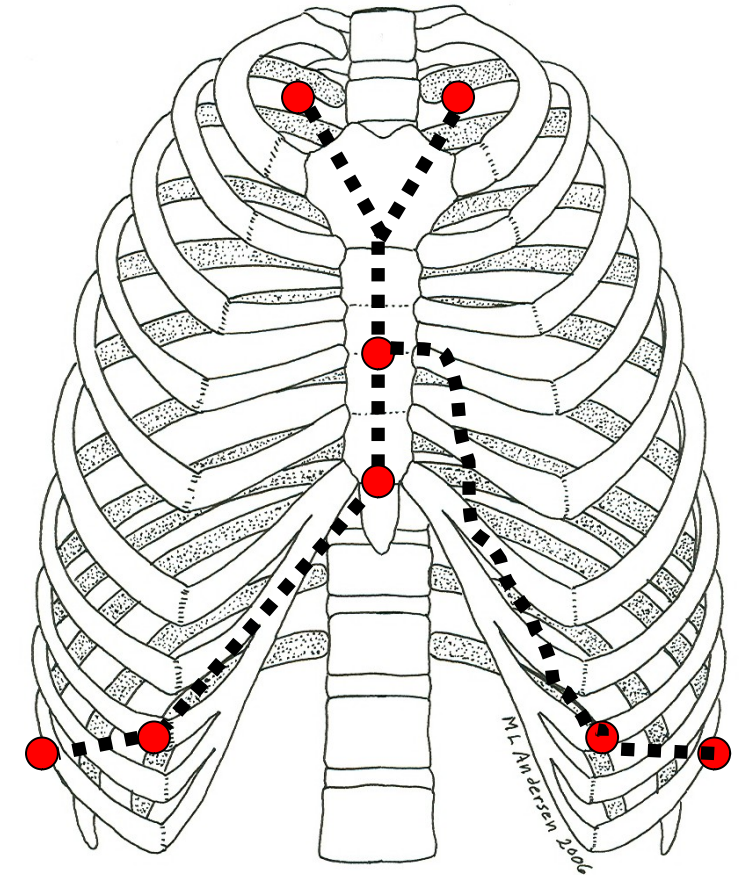


# ***Pleural Surface Anatomy***

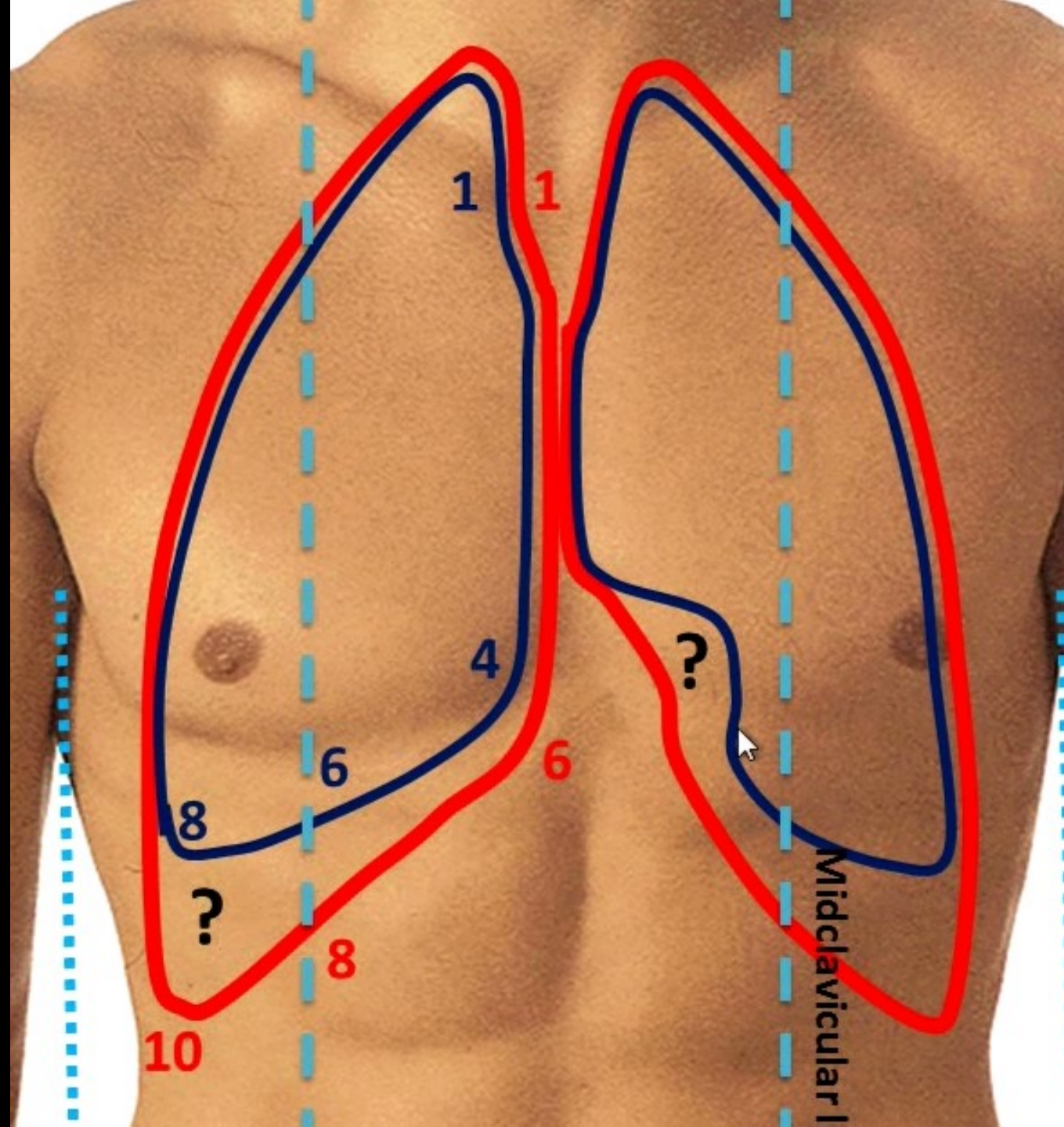


- ***Left side:***

- Leaves sternum at 4<sup>th</sup> costal cartilage
- 1.5 cm from sternal margin at 6<sup>th</sup> costal cartilage.
- Follows same landmarks as right side from this point.



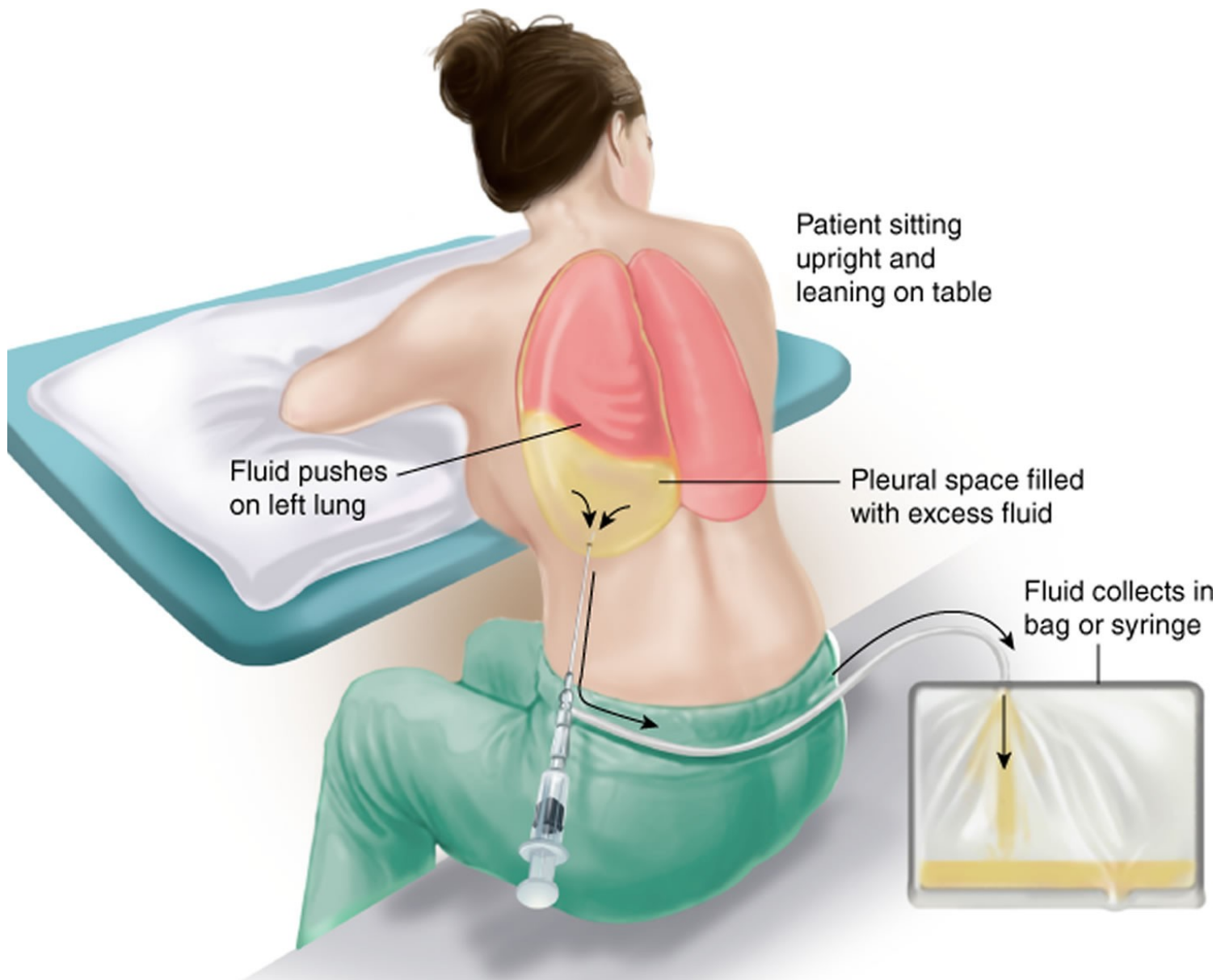
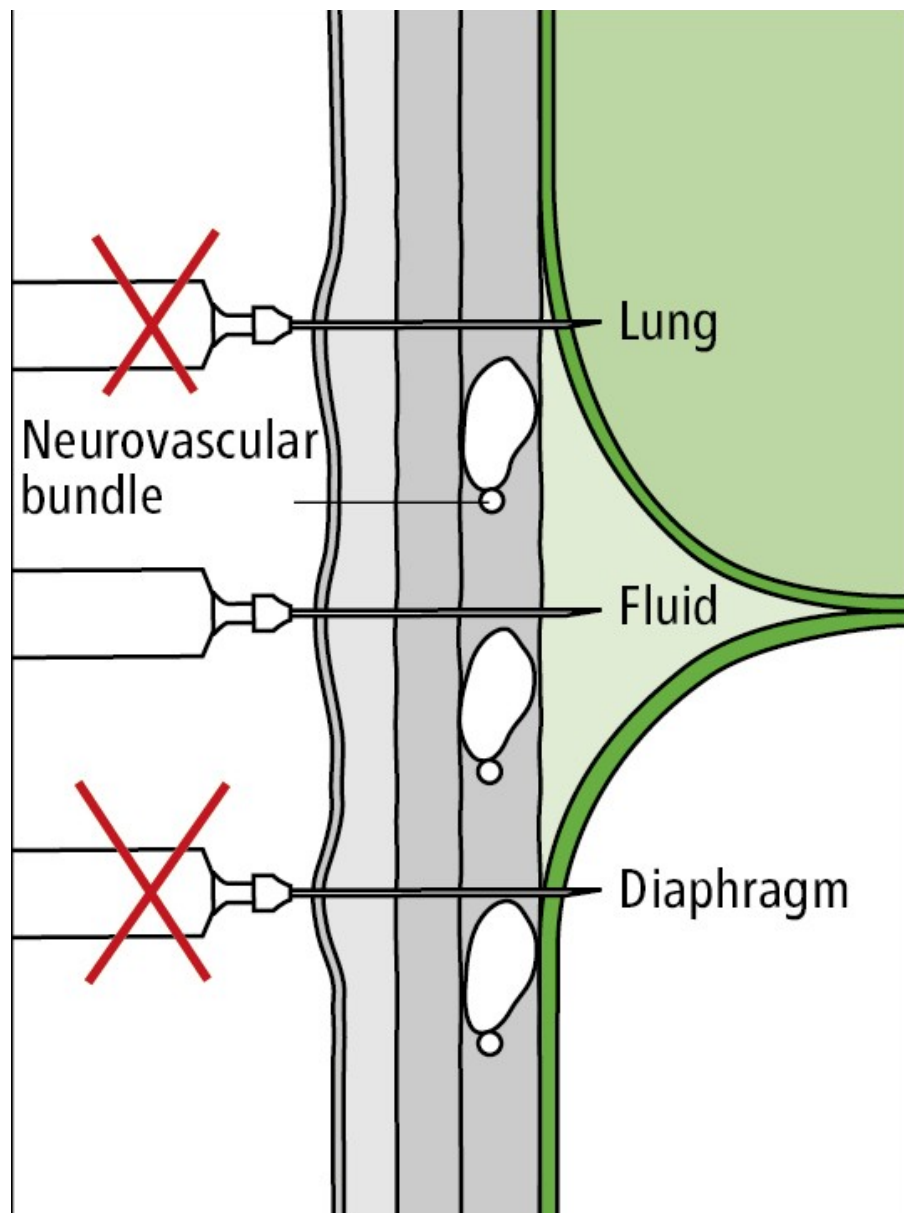




# ***Clinically .....***



- **Fluid** accumulation in a pleural cavity is called ***pleural effusion (Hydrothorax)***.
- **Air** accumulation in a pleural cavity is called ***Pneumothorax***.
- **Blood** accumulation in a pleural cavity is called ***Hemothorax***.
- **Pus** accumulation in a pleural cavity is called ***Empyema***
- Aspiration of any fluid from the pleural cavity is called ***Thoracocentesis***.
- It is usually done in the 6<sup>th</sup> – 7<sup>th</sup> – 8<sup>th</sup> intercostal space in the midaxillary line
- The needle is passed through the lower part of the space to avoid injury to the neurovascular bundle.



# ***Lecture Quiz***



**Lower border of the left pleural sac meets midclavicular line at**

**A. 6<sup>th</sup> rib**

**B. 8<sup>th</sup> rib**

**C. 10<sup>th</sup> rib**

**D. 12<sup>th</sup> rib**



Pleura

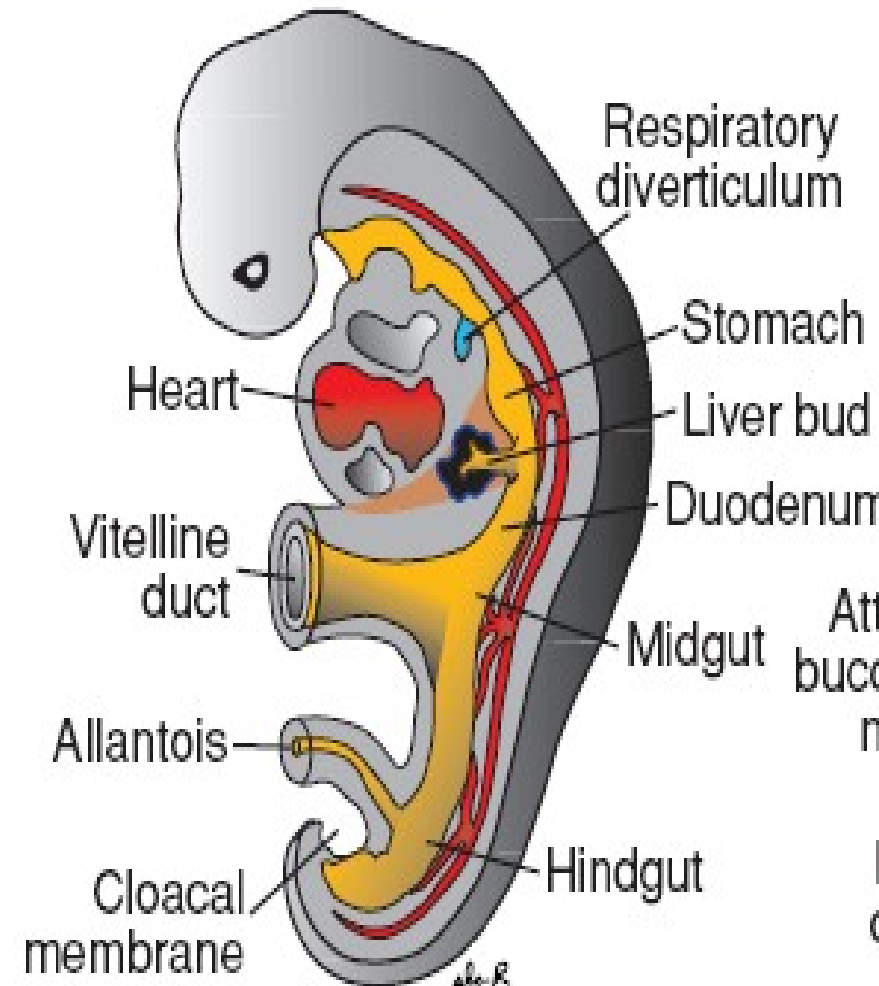
# Development of Respiratory System



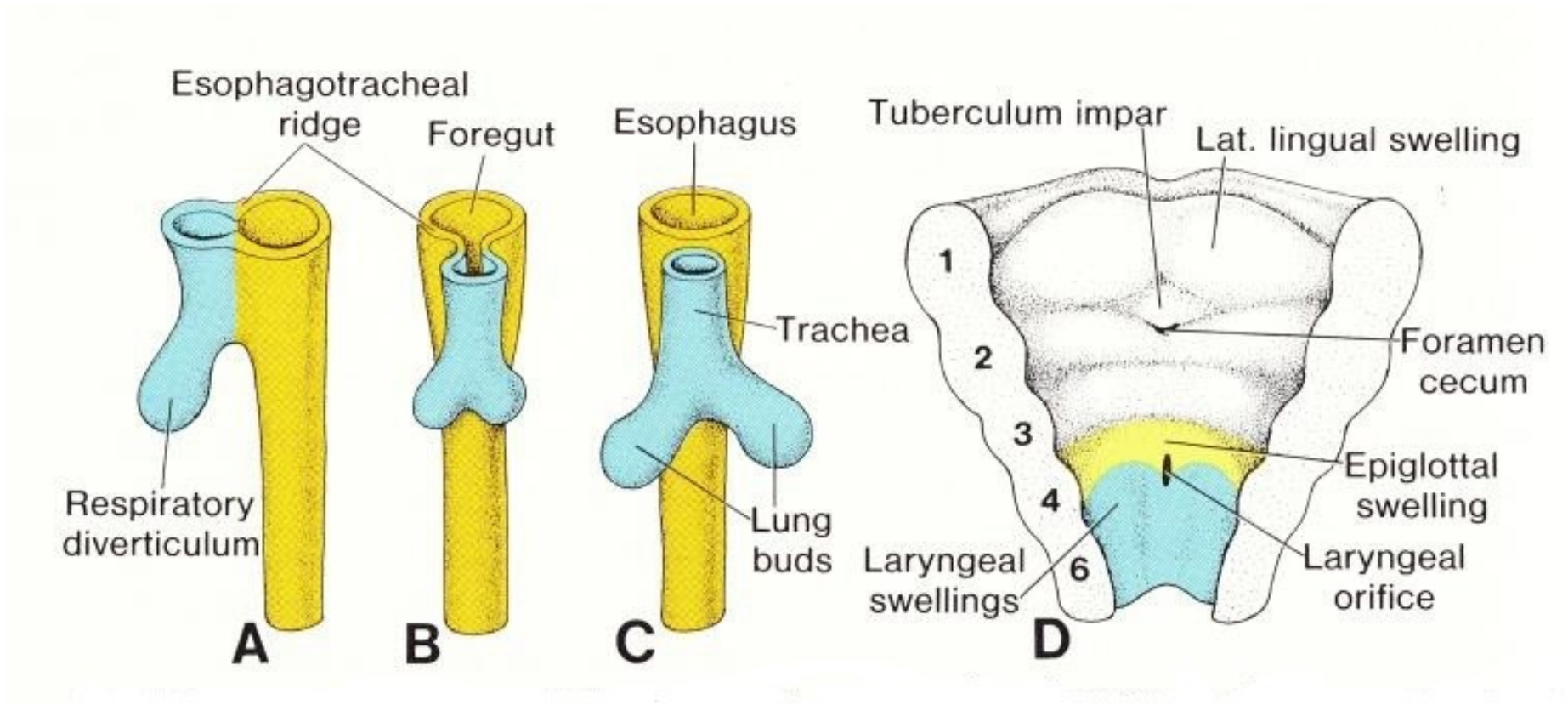
# Respiratory Diverticulum



- When the embryo is approximately 4 weeks old, the **respiratory diverticulum (lung bud)** appears as an outgrowth from the ventral wall of the foregut.
- When the bud expands caudally, two longitudinal ridges, the **tracheoesophageal ridges (septum later)**, separate it from the foregut
- **Its proximal part forms larynx & trachea.**
- **Its distal end divides to give rise to 2 lung buds**



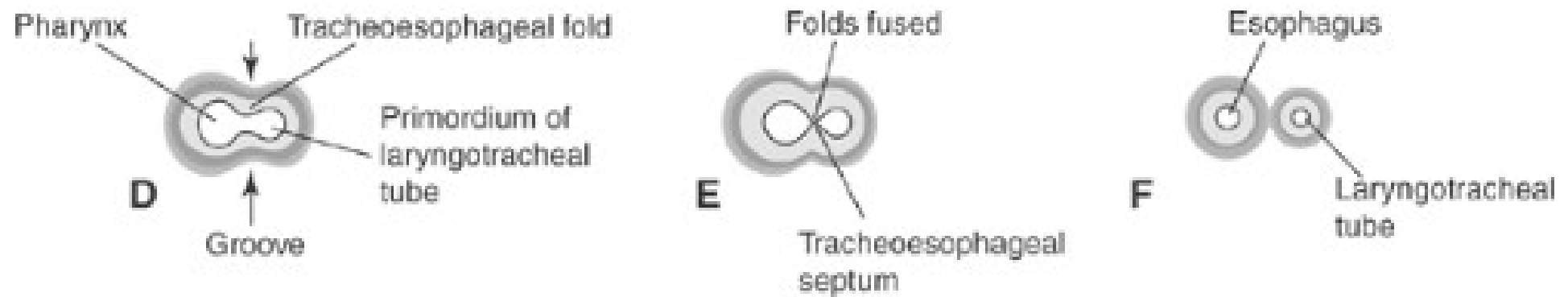
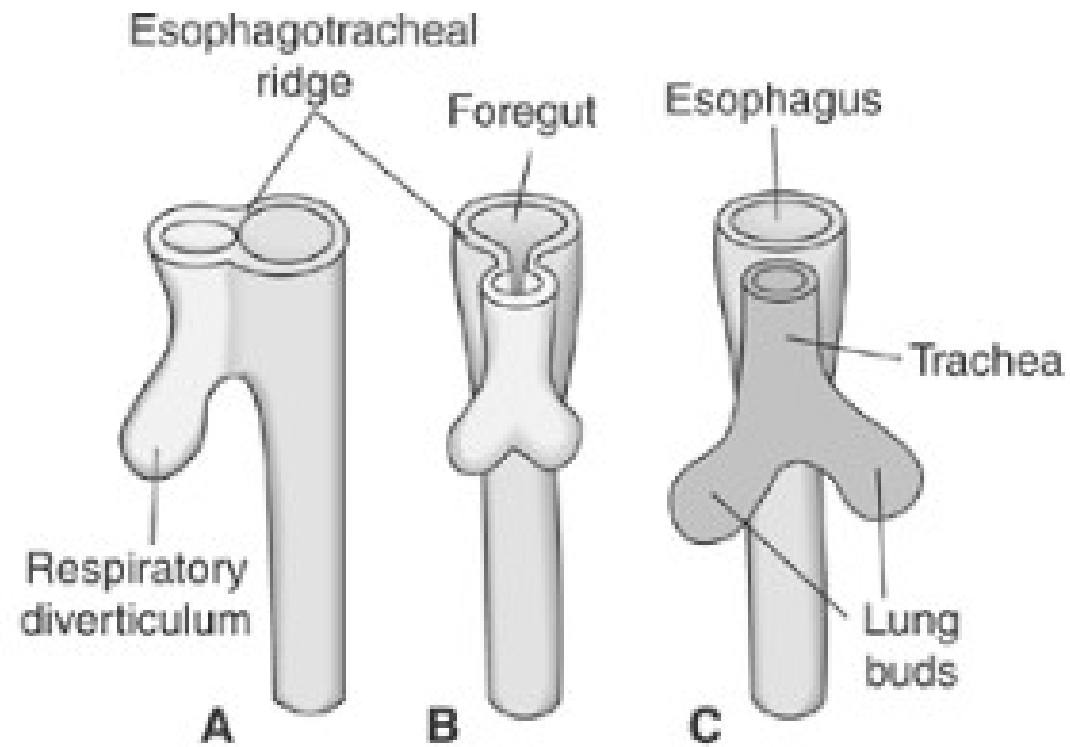




# ***Respiratory Diverticulum***



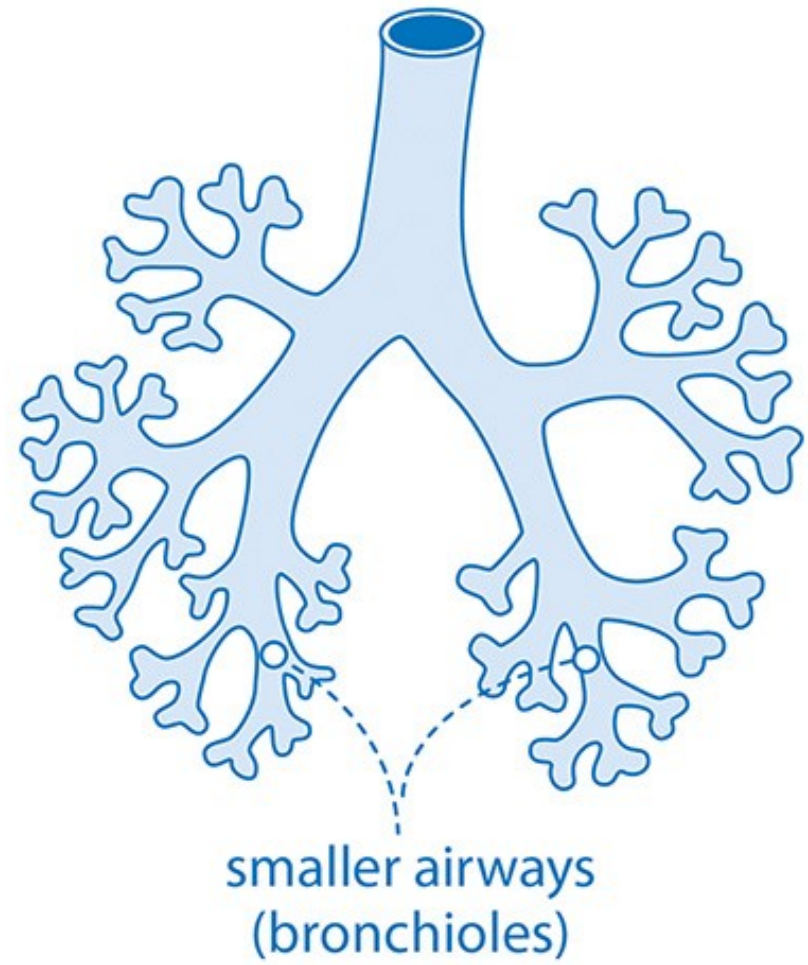
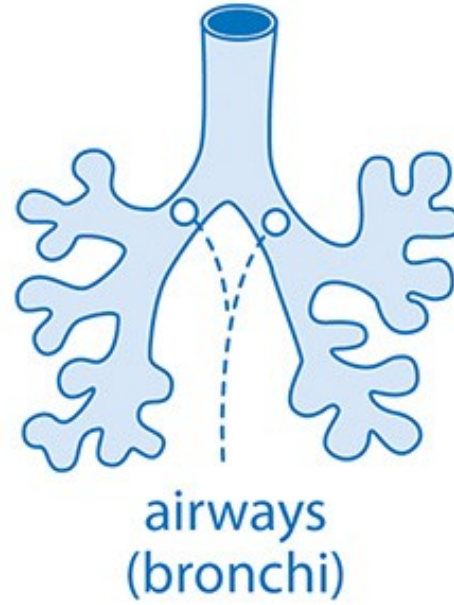
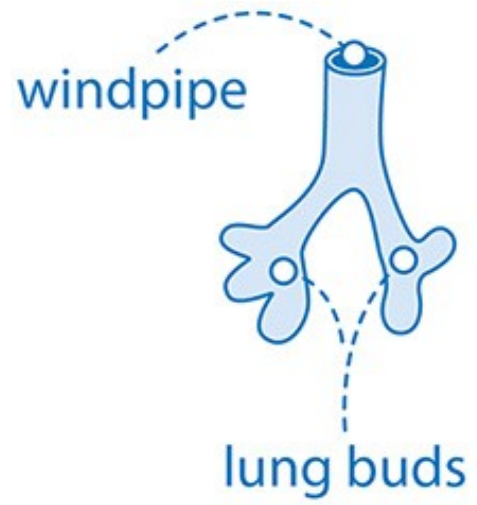
- The ***epithelium*** of the internal lining of the larynx, trachea, and bronchi, as well as that of the lungs, is entirely of ***endodermal origin***.
- The ***cartilaginous, muscular,*** and ***connective tissue*** components of the trachea and lungs are derived from ***splanchnic mesoderm*** surrounding the foregut.
- ***Initially the lung bud is in open communication with the foregut***



# ***Trachea, Bronchi, and Lungs***

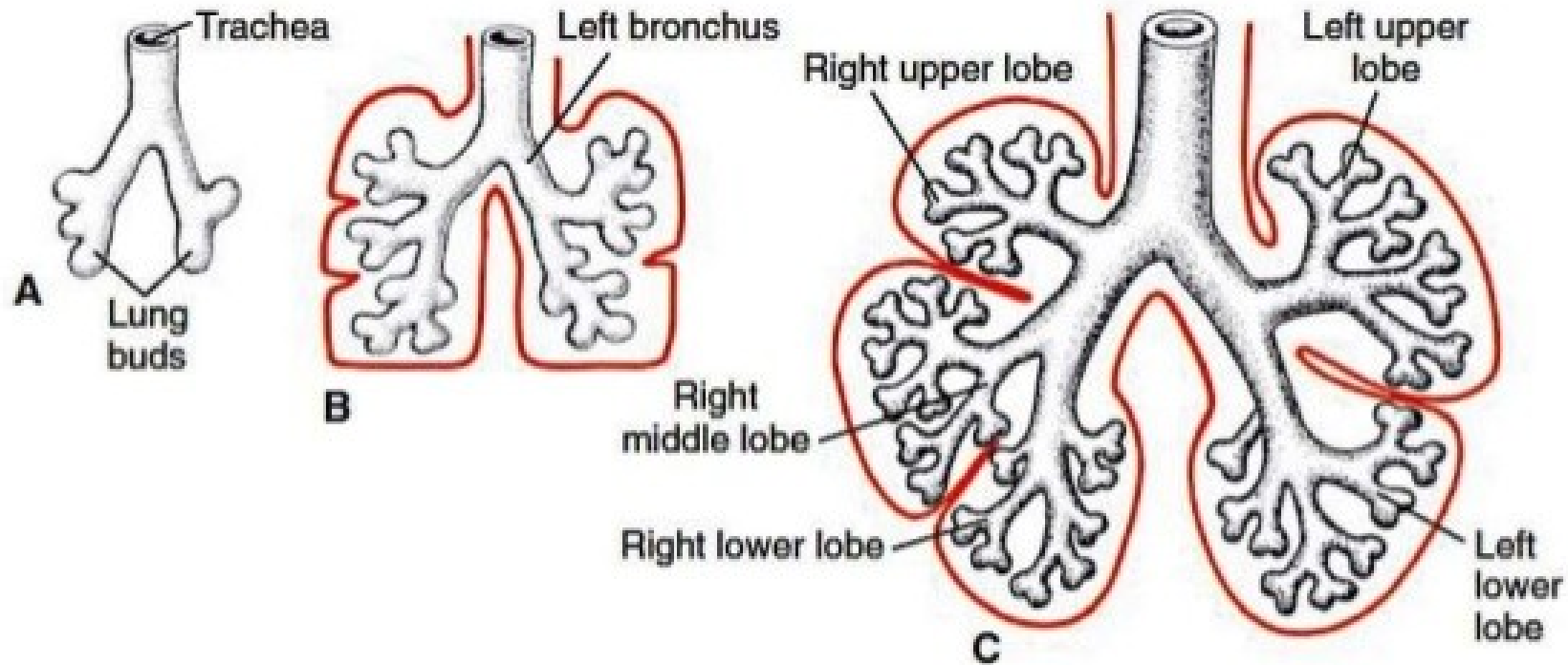


- The ***right bud*** then forms ***three*** secondary ***bronchi***, and the ***left bud forms two***
- ***Thus, foreshadowing the three lobes on the right side and two on the left.***





# Trachea, bronchi & lungs



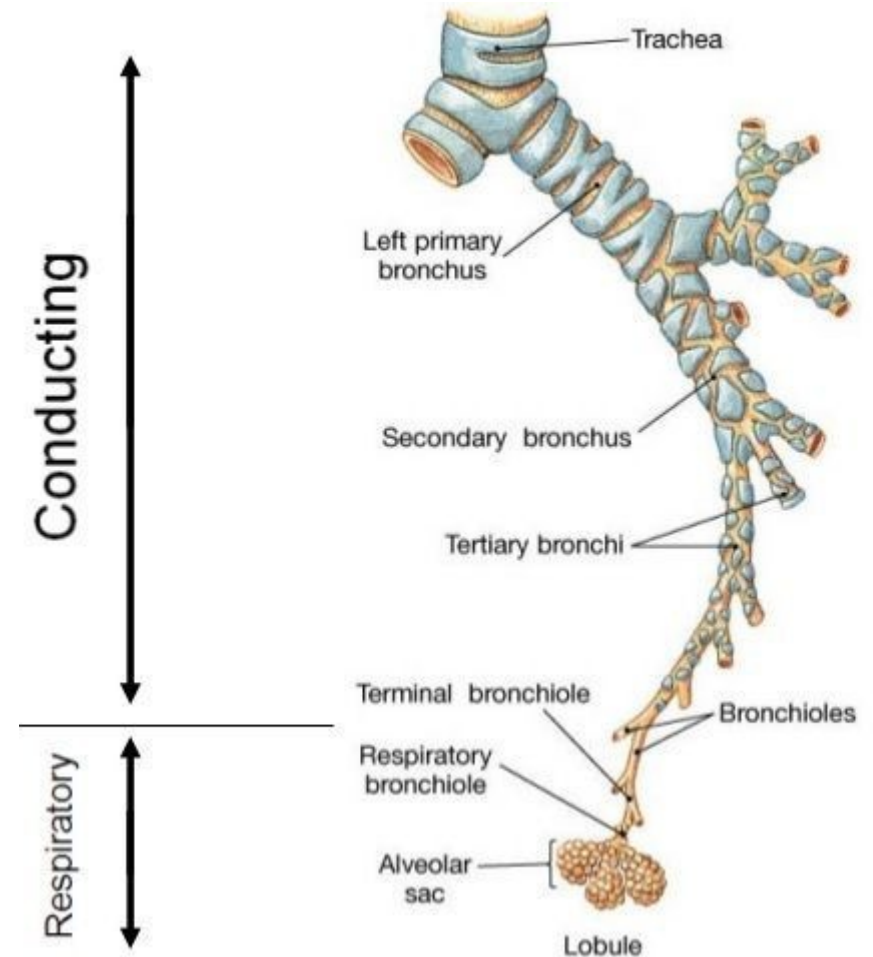
Prenatal: 17 generations

Postnatal: 6 generations

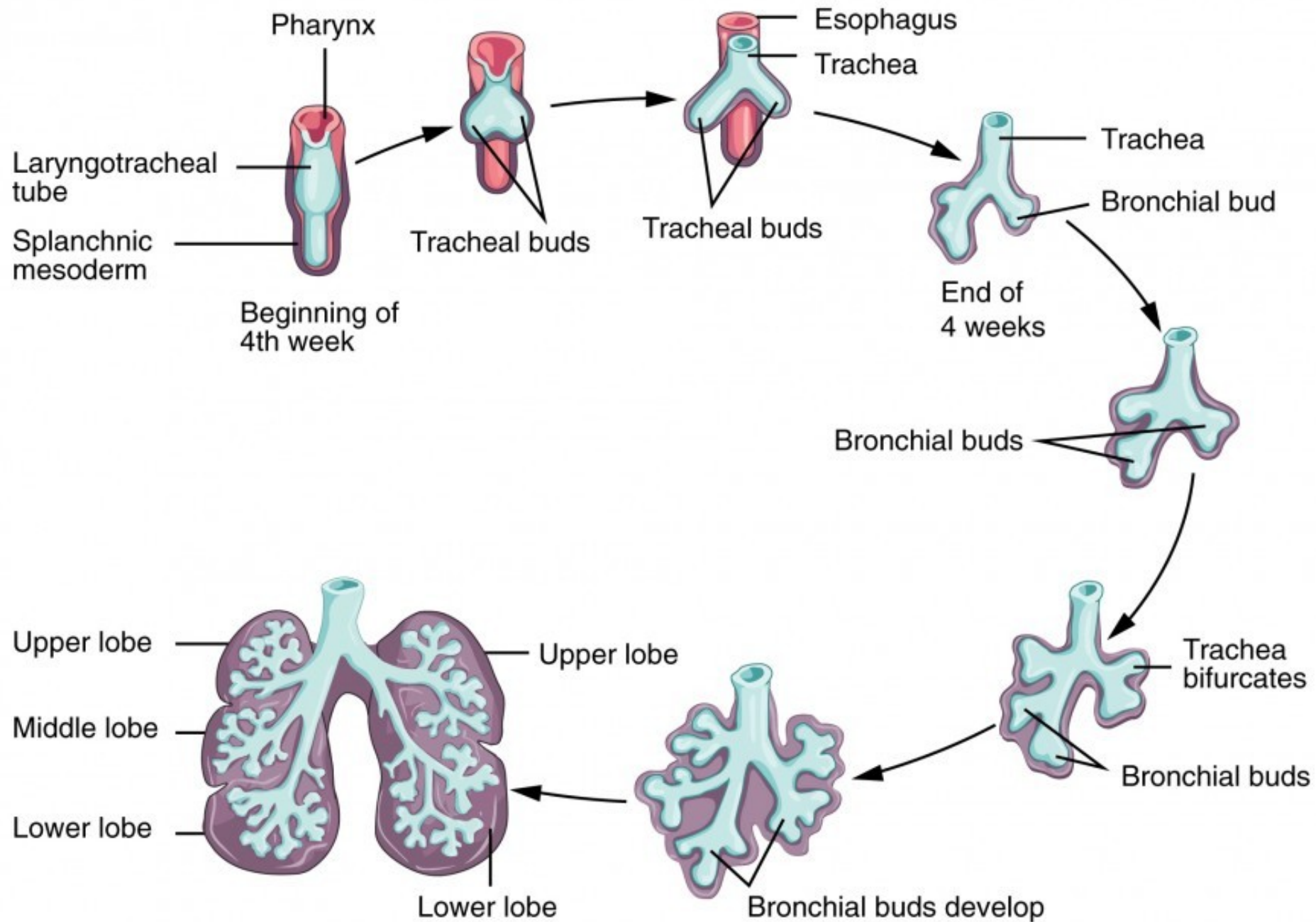
# Development of the Respiratory System



By **6<sup>th</sup> month**, about 17 orders of branches have formed ending in **respiratory bronchioles**, then **after birth alveoli** is formed



[https://www.google.com/url?sa=i&source=images&cd=&ved=2ahUKEwi8v\\_aHvrrjAhUC3xoKHbzdA54QjRx6BAgBEAU&url=https%3A%2F%2Fwww.pinterest.com%2Fpin%2F378935756144392062%2F&psig=AOvVaw0qjmAmhzvNoTGUSRYwHZdC&ust=1563402359938076](https://www.google.com/url?sa=i&source=images&cd=&ved=2ahUKEwi8v_aHvrrjAhUC3xoKHbzdA54QjRx6BAgBEAU&url=https%3A%2F%2Fwww.pinterest.com%2Fpin%2F378935756144392062%2F&psig=AOvVaw0qjmAmhzvNoTGUSRYwHZdC&ust=1563402359938076)



# ***Lung Anomalies***

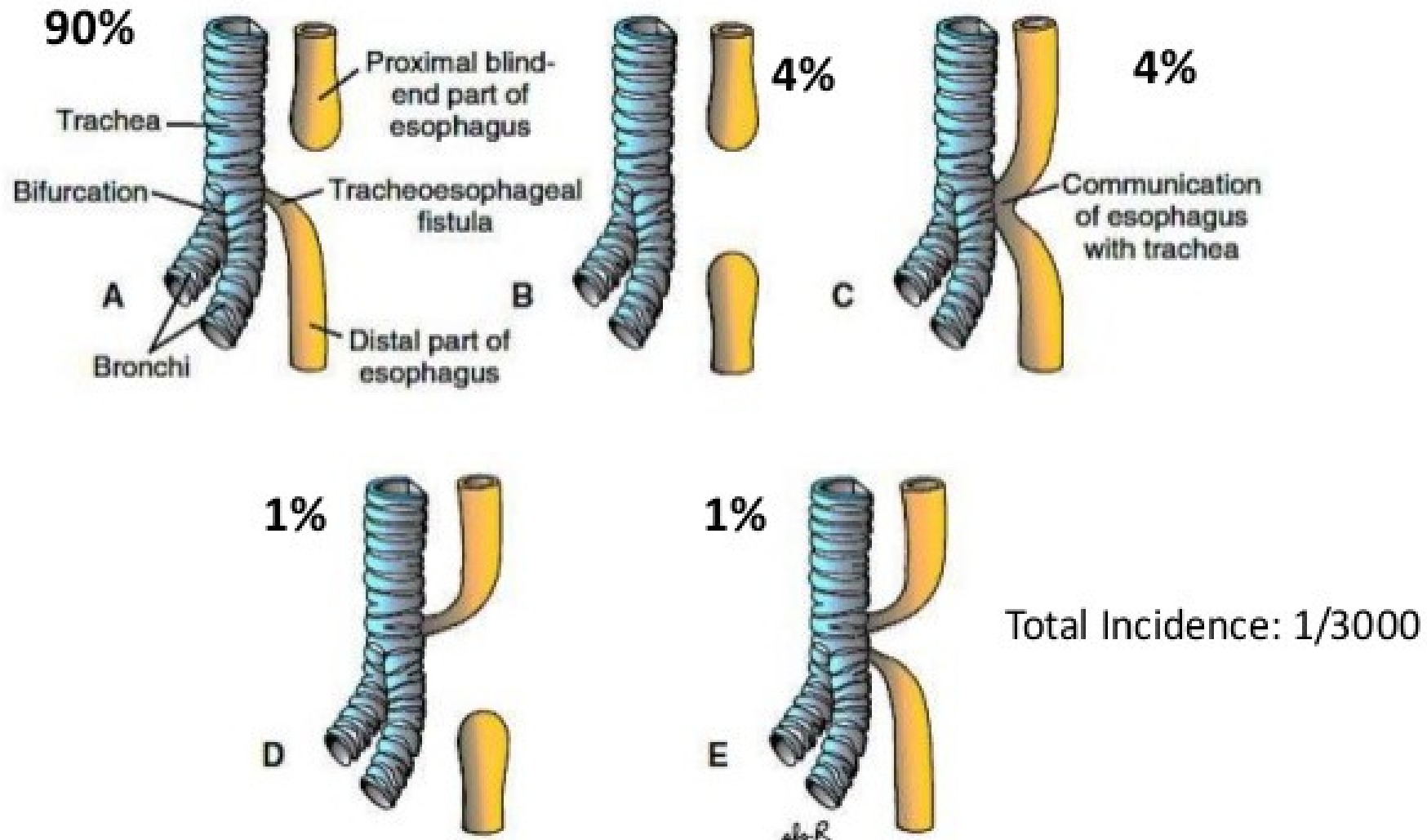
# Clinical Notes



- **Although many abnormalities of the lung and bronchial tree have been found (e.g., blind-ending trachea with absence of lungs and agenesis of one lung) most of these gross abnormalities are rare**
- Abnormal **divisions of the bronchial tree** are more **common**, some result in supernumerary lobules.
- **These variations** of the bronchial tree **have little functional significance, but of importance for surgical considerations.**



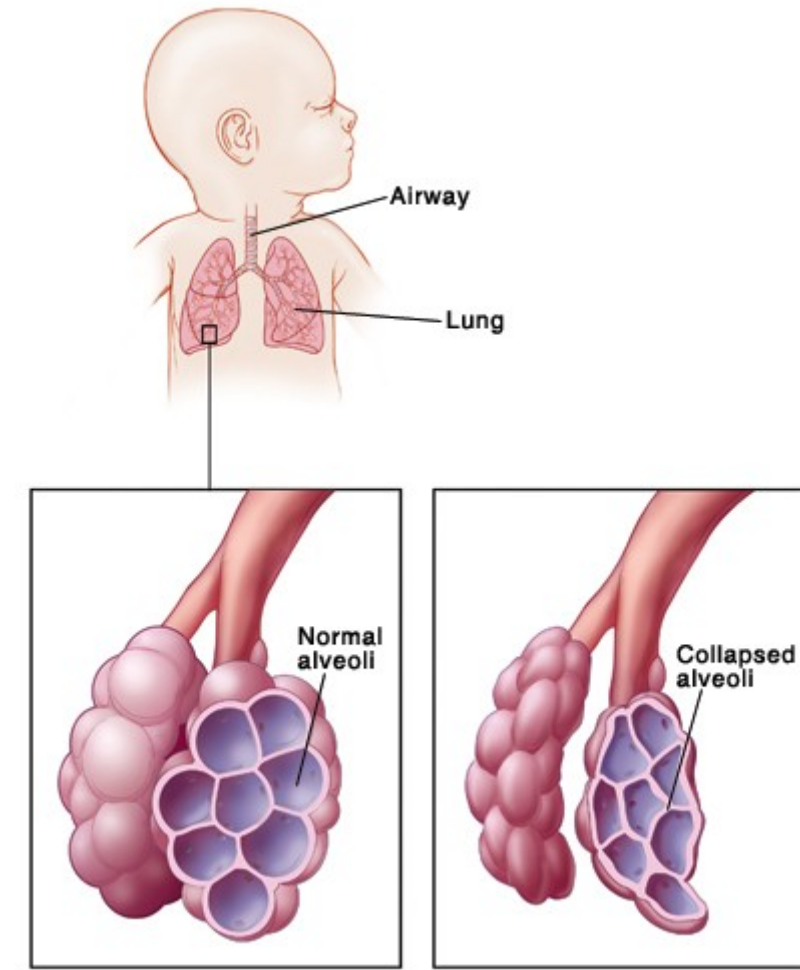
# Defects in partition of foregut esophageal atresia / Tracheo-esophagal fistula



# ***Congenital Anomalies***

## ***Neonatal Respiratory Distress Syndrome (NRDS)***

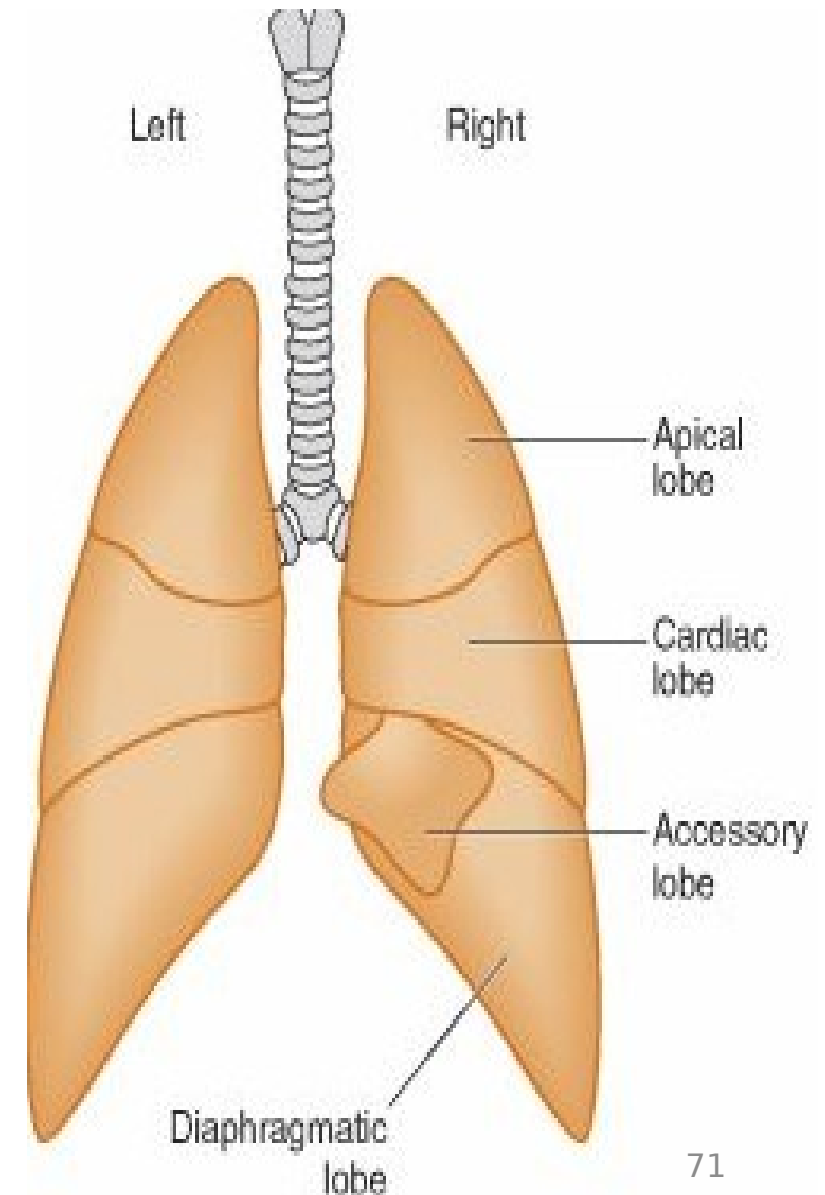
The disease is mainly caused by a lack of a slippery substance in the lungs called surfactant. This substance helps the lungs fill with air and keeps the air sacs from deflating. Surfactant is present when the lungs are fully developed.



# ***Congenital Anomalies***



## **Ectopic lung lobes**



# Congenital Cysts of the lung

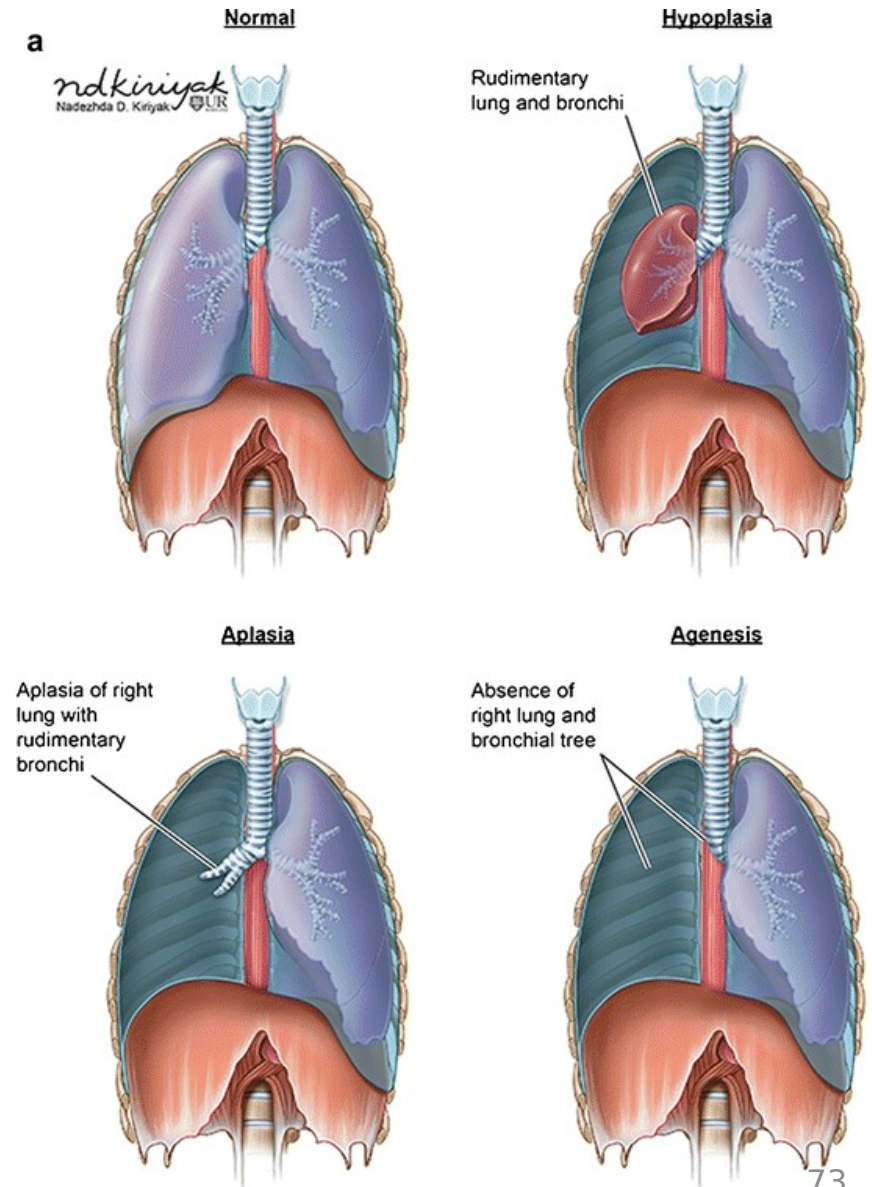
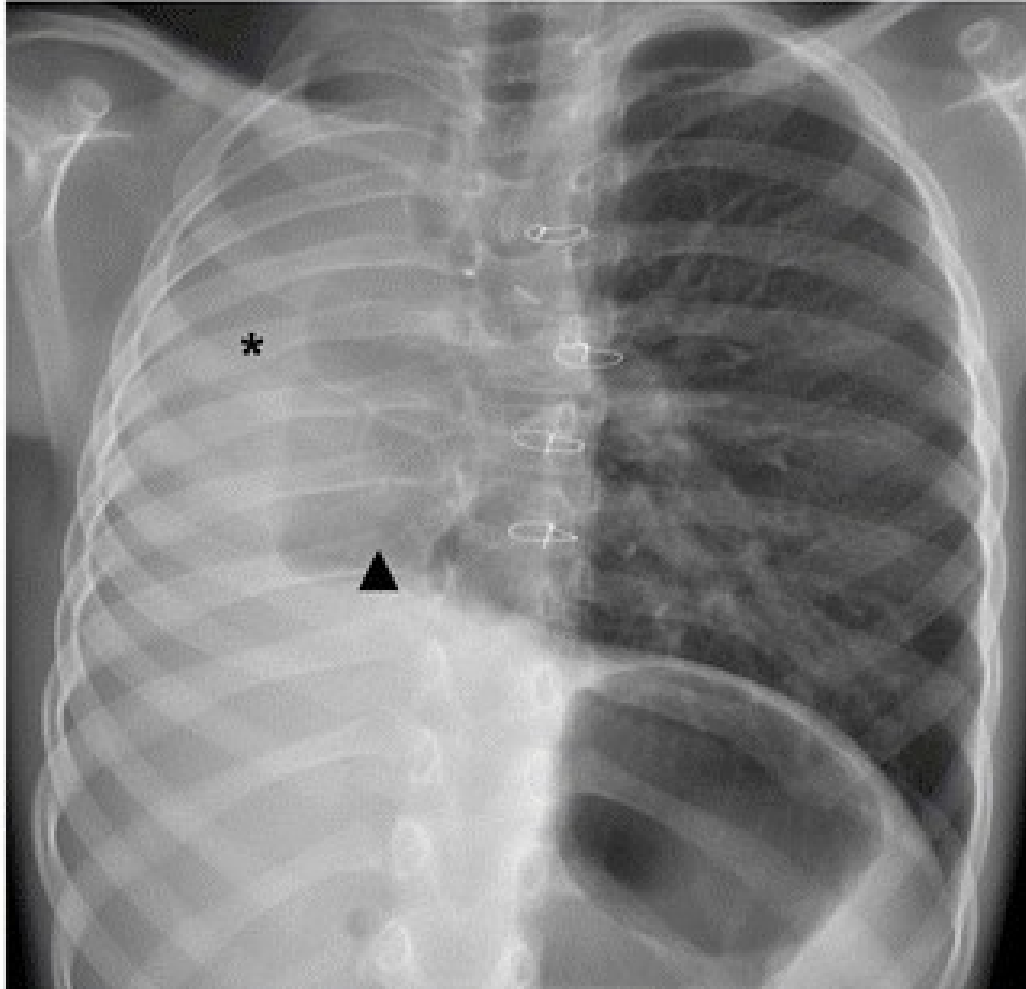


- *Solitary or part of polycystic lung disease*
- These cysts may be small and multiple, giving the lung a honeycomb appearance on radiograph



# Lung Agenesis and Hypoplasia

b





# ***Lungs of the Newborn Infants***



- **Fresh and healthy lungs contain some air so pulmonary samples float in water**
- **The lungs of the stillborn infants are firm and sink in water because they contain fluids not air.**

# ***Lecture Quiz***



• **Development of respiratory system starts at:**

**A. 3<sup>rd</sup> week**

**B. 4<sup>th</sup> week**

**C. 5<sup>th</sup> week**

**D. 6<sup>th</sup> week**

## ***SUGGESTED TEXTBOOKS***

- Clinical Anatomy for Medical Students.  
Richard S. Snell
- Gray's anatomy for students .



**For further inquiries PLZ feel  
free to contact at any time  
through email**

**[gamaltaha@med.asu.edu.eg](mailto:gamaltaha@med.asu.edu.eg)**

**[Gamal\\_Abdel-Hadi@afcm.edu.eg](mailto:Gamal_Abdel-Hadi@afcm.edu.eg)**



*Thank You*